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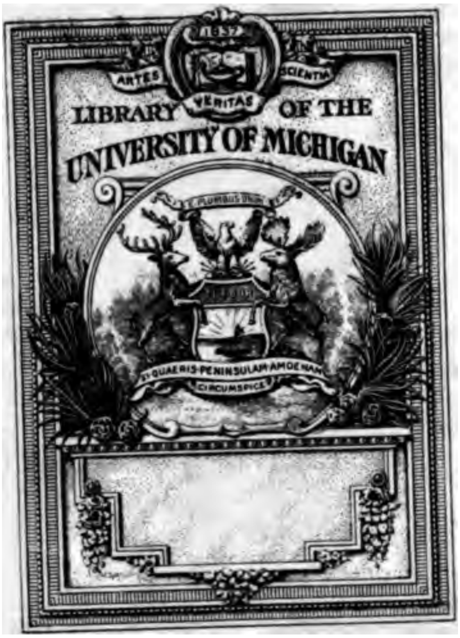

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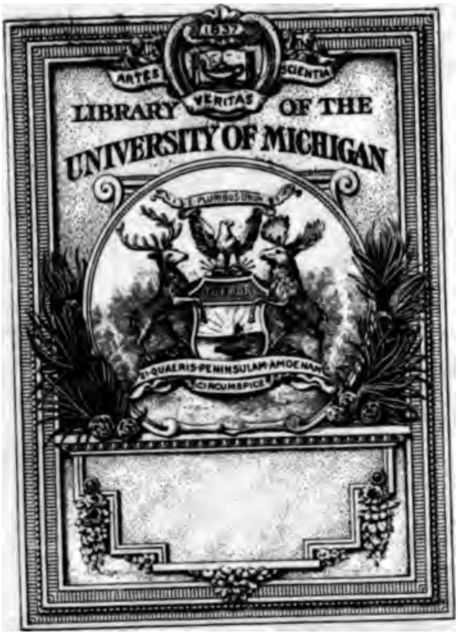

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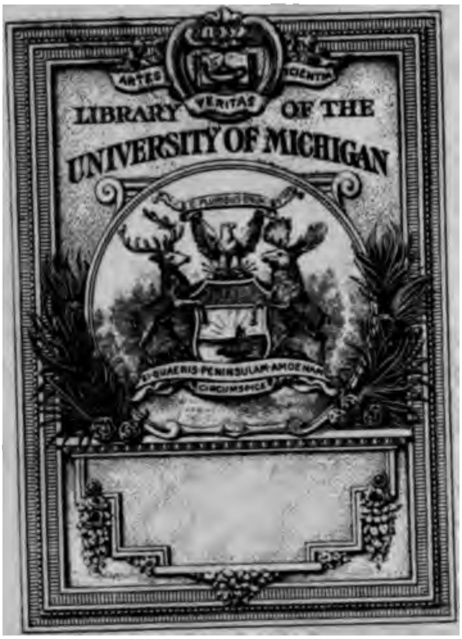
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# ANNUAL REPORTS

OF THE

# WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1904.

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## VOLUME VII.

## REPORT OF THE CHIEF OF ENGINEERS.

## PART 3.

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

# ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1904.

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- Chief of Staff.
- The Military Secretary.
- Inspector-General.
- Judge-Advocate-General.

**Volume II**.......**Armament, Transportation and Supply:**
- Quartermaster-General.
- Commissary-General.
- Surgeon-General.
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- Chief of Engineers, Military Affairs.
- Chief of Ordnance.
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# APPENDIXES

TO THE

# REPORT OF THE CHIEF OF ENGINEERS,

## UNITED STATES ARMY.

(CONTINUED.)

# APPENDIX D D.

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# IMPROVEMENT OF OHIO RIVER BY OPEN-CHANNEL WORK AND CONSTRUCTION OF LOCK AND DAM NO. 37; OPERATING SNAG BOATS ON OHIO RIVER.

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## *REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. Ohio River (general improvement).
2. Construction of Lock and Dam No. 37, Ohio River.
3. Operating snag boats on Ohio River.

### EXAMINATIONS.

4. Bridges over Ohio River impeding safe and convenient navigation.
5. Ohio River at Elizabethtown, Illinois.
6. Ohio River at Mound City Harbor, Illinois.
7. Ohio River from Mound City to Cairo, Illinois.
8. Ohio River near mouth of Green River, Kentucky.
9. Ohio River at Ogden Landing, Kentucky.

### HARBOR LINES.

10. Ohio River at Steubenville and Mingo, Ohio.
11. Ohio River from Ashland, Kentucky, to Hanging Rock, Ohio.

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United States Engineer Office,
*Cincinnati, Ohio, July 19, 1904.*

General: I have the honor to transmit herewith the annual reports of the works under my charge for the fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

G. J. Lydecker,
*Colonel, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## D D 1.

## IMPROVEMENT OF OHIO RIVER.

### GENERAL IMPROVEMENT.

Operations on this improvement were in progress during the last fiscal year under the general project that has been in force for many years, as follows:

*Dredging.*—At the commencement of the fiscal year the U. S. dredges *Ohio* and *Oswego* were engaged on the work begun in June at Twin Creek Bar, 372.4 miles below Pittsburg, the purpose being to widen and straighten the channel by cutting away the points of the creek bars which project into it from both sides of the river. The excavation made July 1 to September 1 was 72,266 cubic yards of gravel, bowlders, and sand, the width of area dredged during the season being 325 feet and the extreme length 2,050 feet, making a straight channel through the ripple with a general depth of from 5 to 6 feet below low water. The work at this place was attended with much difficulty, as the river bed consists of compact bowlders and gravel, causing much delay and many accidents to machinery. While stationed at this point the dredges removed from the channel 4 logs and snags weighing 5.4 tons and 1 rock, 1.3 tons, and also, on July 25, broke up and removed a sunken coal barge which blocked the towboat channel at Manchester Island, 21 miles below.

After finishing work at Twin Creek the dredges were moved to Sand Creek Bar, 220 miles below Pittsburg, where the narrow and crooked channel had long interfered with navigation and caused much loss to coal tows. The dredging added 160 feet to the width of the channel, with depth of 4 to 5 feet below low water for a length of 2,700 feet, and 225 feet width with 6 feet low-water depth for an additional distance of 1,000 feet, the total length widened being 3,700 feet, easy passage for coal tows as well as packets being thus assured. The total excavation was 95,303 cubic yards gravel and sand; 3 logs and snags weighing 3.5 tons, and 10 rocks, 23.4 tons, were also removed.

Operations were suspended November 28 by cold weather, when the dredging plant proceeded to establish winter quarters in the Little Kanawha River at Parkersburg, and did not resume work until June 11, 1904. From that date till the close of the fiscal year the dredges were working at Blair Run Bar and Coon Run Bar, 113 to 115 miles below Pittsburg. The total excavation at these two points was 25,923 cubic yards of gravel, bowlders, and loose rock, 4 rocks weighing 8.2 tons, and 2 logs weighing 2 tons.

During the suspension of active dredging operations extensive repairs were made to the United States plant.

*Rock excavation.*—Operations on removal of the bar at the mouth of the Licking River, 468.4 miles below Pittsburg, were resumed August 6, 1903, on the drilling and blasting of the solid rock, and continued until November 7, when the entire area outlined in the project had been prepared for excavation to the required depth, this work being carried on, as in previous seasons, by the Government drill boat and hired labor. The dredging of blasted material and loose rock was resumed August 1, 1903, and carried on continuously, except as noted below, until December 5, when all loose material had been removed. The plant employed for this purpose consisted of a dredge, towboat, and flatboats, serving under contract; it was necessary, however, to twice withdraw the dredge in order to facilitate work at other points, viz: For eight days (August 27–September 4) to remove wrecks and a bar at Rising Sun, Ind., and for eight days (September 27–October 5) to excavate for foundations for the ice pier at Maysville, Ky. Four thousand and eighty-nine cubic yards solid rock were drilled and blasted during the season, and 19,576 cubic yards of blasted rock, loose rock, sand, and gravel were dredged from the channel and towed to Cullums Ripple, 6 miles below Cincinnati, where it was deposited behind the dike at that point. The cost of the work during the fiscal year, including all items of expense except that attaching to the general office, was $3.05 per cubic yard of material excavated. The work done completes the projected improvement at this point, and provides a 4-foot low-water channel having a minimum width of 200 feet from navigable water in the Ohio to a similar point within the Licking.

Work done here since operations were commenced in 1901 included drilling 7,537 holes aggregating 27,483 feet in depth; blasting 11,225 cubic yards of solid rock, and dredging 57,881 cubic yards of blasted rock, loose rock, gravel, and sand.

*Repairs of low dams and dikes* were made as follows: At Belleville Island, 203 miles below Pittsburg, 725 cubic yards of stone were placed between September 14 and October 10, thereby filling gaps and restoring the work to its original level; at Newbury Island, 193.6 miles below Pittsburg, 2,016 cubic yards of stone were placed between October 12 and November 6, 1903, thereby leveling its crest to a 4-foot stage and leaving it in good condition for the winter; and at Eight Mile bar, 455.5 miles below Pittsburg, the spur dikes built in 1892–93 were leveled up by distributing 1,180 cubic yards of stone in August and September, and the timber crib dike built in 1886 was partly repaired between November 16 and December 5 with the use of 11,140 feet B. M. oak timbers and 70 cubic yards stone.

*Ice piers.*—Near mouth of Big Hocking, 198.6 miles below Pittsburg. The preparations in progress at the close of the last fiscal year for the construction of this pier at Harris Ferry, W. Va., under the project approved July 31, 1902, were continued, but high water prevented the laying of concrete until early in August, and before this was begun the Pittsburg Coal Exchange protested against the pier as a serious menace to coal-boat navigation; a public hearing of interested parties was held at Cincinnati, August 13, at which the opinions expressed were found to accord in general with the objections made by the coal exchange. A recommendation was accordingly submitted that the construction of this pier be abandoned and the plant and materials used elsewhere; this course was approved September 5, 1903.

At Maysville, Ky., 407.4 miles below Pittsburg: The provision contained in the river and harbor act of July 13, 1902, for ice piers at various localities, included a new pier at this place, for which a project was approved July 28, 1902, but as the relinquishment of riparian rights could not be obtained for the entire site fixed upon, a second survey was made in July and August, 1903, and a new site adopted about 450 feet below that previously selected. During September the plant, tools, and cement that had been provided for the abandoned pier at Harris Ferry were brought to this point; the hired dredge was transferred temporarily from Licking Bar to excavate for foundations of the cribs, and work vigorously pushed in order to place the pier in condition to withstand floods and ice, and be available for service during the ensuing winter. Although conditions were extremely unfavorable, the superstructure of all three cribs was completed to the proposed height of about 13 feet above low water when ice floes appeared on December 5, and the plant was stored and operations closed for the season. Reports received from interested parties state that the pier, though not yet completed to the requisite height, afforded valuable harborage during the subsequent period of heavy ice.

*Harbor lines.*—Preparatory to the final adoption of harbor lines at Steubenville and Ironton, Ohio, tracings were submitted July 8, 1903, showing the definite course of the lines as proposed at each location, those at Steubenville covering a distance of 6.8 miles, and at Ironton 9.05 miles. These lines were approved by the Acting Secretary of War October 30 and 31, 1903, respectively.

The usual work was continued during the year in the investigation of encroachments, and of permits requested or authorized, and also in preparing cross-section drawings of the lines at various points.

*Permits.*—Applications for special permits have been less numerous than in former years, but the work has still required a considerable expenditure of time and labor for the necessary examinations in the field and the subsequent supervision, in order to secure compliance with harbor-line restrictions and prevent interference with the interest of navigation. The total number of permits granted during the year and pertaining to this district was 17, of which 2 were for intake cribs and pipes, 3 for gas-pipe lines, 4 for oil-pipe lines, 5 for overhead wires and cables, 1 for sewer outlet, 1 for logway, and 1 for filling along bank.

*Bridges.*—Plans submitted by the Newell Bridge Company for a highway suspension bridge across the Ohio River at East Liverpool, Ohio, with a channel span of 750 feet, were approved by the Assistant Secretary of War July 9, 1903. It subsequently developed that the borough could not convey to the bridge company a clear title to the landing on the Ohio side as proposed, and a change in axial location about 73 feet upstream was authorized by the Assistant Secretary of War April 19, 1904.

Plans submitted by the Steubenville Bridge Company for a highway bridge across the Ohio River from the foot of Market street, Steubenville, Ohio, to a point opposite in West Virginia, with a channel span of 700 feet were approved, as modified, by the Assistant Secretary of War June 29, 1903; a further modification by a slight change in location of piers but preserving the original width of channel span was approved by the Acting Secretary of War April 6, 1904.

Under permits formerly granted for a bridge between Ashland, Ky., and Ironton, Ohio, and for one between Bellaire, Ohio, and Benwood, W. Va., actual construction had been delayed beyond the limits prescribed by law; but as extensive preparations had been made in both cases, the original plans were reapproved by the War Department under date of January 29, 1904, and April 21, 1904, respectively.

The highway bridge across the Ohio between Marietta, Ohio, and Williamstown, W. Va., built by the Ohio River Bridge and Ferry

Company upon plans approved Decmber 13, 1900, was completed and opened for traffic in September, 1903. Report on inspection submitted to the Chief of Engineers January 20, 1904.

The false work for reconstructing the channel spans of the Bellaire-Benwood bridge having been commenced by the Baltimore and Ohio Railroad Company, notwithstanding the refusal of the War Department to approve the plans submitted, a protest was made by the Pittsburg Coal Exchange against the perpetuation of the contracted channel spans; pursuant to which telegraphic instructions were received from the Chief of Engineers to request the United States attorney for the northern district of West Virginia to enjoin the railroad company from proceeding further. This application was, however, refused by the court and a counter order was granted the railroad company restraining interference with the work until after a hearing set for October 16 at Clarksburg, W. Va., when the request for injunction was finally refused and the temporary restraining order confirmed. The channel spans have accordingly been renewed on the old piers, thereby perpetuating the conditions that have long constituted a serious obstruction to navigation.

A report required by the river and harbor act of June 13, 1902, on bridges which are considered impediments to safe and convenient navigation was submitted December 22, 1903, and is printed herewith in Appendix D D 4.

*Surveys.*— Field work over the worst portions of the river between Petersburg and Louisville, Ky., a distance of 110 miles, was in progress from August 1 to December 1, 1903, with a view to the preparation of projects for future improvements, and the data obtained were plotted.

### ESTIMATE.

The balance of the funds now available will be applied during the current fiscal year in accordance with the project, in dredging, construction and repairs of ice piers, low dikes and dams, surveys, and general contingencies, of supervision, engineering, and office.

For further operations under the general project of improvement, for continuing the general survey of the river down to its mouth in continuation of work recently completed as far down as the Big Miami, and for procuring a much more efficient working plant for open-channel improvement additional funds are urgently needed, as indicated in the money statement below, and the appropriation of that sum is recommended with all permissible force.

The funds provided by the river and harbor act of June 13, 1902, will not suffice for building the new ice pier at Maysville, Ky. It is therefore recommended that the unexpended balance of the moneys made available by the same act for expenditure in the discretion of the Secretary of War for constructing an ice pier near the mouth of the Big Hocking River be transferred and made applicable to completing the new Maysville pier, the project for the Big Hocking pier having been abandoned, as previously stated in this report, and the unexpended balance of funds pertaining to it being $22,127.41.

Subreports of assistants in charge of the principal work referred to above are submitted herewith and furnish interesting detailed information, as follows: Reports by Chief Asst. Engineer R. R. Jones on (1) removing rock bar at mouth of Licking, (2) repair of dikes and dams, (3) ice piers, and (4) report of Asst. Engineer E. J. Carpenter on dredging operations.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | [a] $374,596.83 |
| July 24, 1903, by amount received from sale of cement | | 102.30 |
| June 13, 1904, by Treasury settlement | | 261.45 |
| June 20, 1904, by amount received from sale of condemned property | | 58.13 |
| | | 375,018.71 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $122,317.62 | |
| For maintenance of improvement | 22,246.69 | |
| | | 144,564.31 |
| July 1, 1904, balance unexpended | | 230,454.40 |
| July 1, 1904, outstanding liabilities | | 4,010.57 |
| July 1, 1904, balance available | | 226,443.83 |
| July 1, 1904, amount covered by uncompleted contracts | | 6,569.52 |
| Amount (estimated) required for completion of existing project | | Indefinite. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $400,000.00 | |
| For maintenance of improvement | 100,000.00 | |
| | | 500,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

*Statement of amounts and dates of all appropriations for this work.*

| Act of Congress. | Appropriation. | Allotment. | Remarks. |
|---|---|---|---|
| March 3, 1827 | $30,000.00 | | |
| March 3, 1835 | 50,000.00 | | |
| July 2, 1836 | 20,000.00 | | |
| March 3, 1837 | 60,000.00 | | |
| July 7, 1838 | 50,000.00 | | |
| June 11, 1844 | 100,000.00 | | |
| March 3, 1847 | 6,479.25 | | |
| August 30, 1852 | 90,000.00 | | |
| June 23, 1866 | | $172,000.00 | Improving Mississippi, Missouri, Arkansas, and Ohio rivers. |
| Do | | 80,000.00 | Snag boats and apparatus for improving Western rivers. |
| March 2, 1867 | 100,000.00 | | |
| July 25, 1868 | | 85,000.00 | Repair, preservation, extension, and completion of river and harbor works. |
| July 11, 1870 | 50,000.00 | | |
| March 3, 1871 | 50,000.00 | | |
| June 10, 1872 | 200,000.00 | | |
| March 3, 1873 | 200,000.00 | | |
| June 23, 1874 | 150,000.00 | | |
| March 3, 1875 | 300,000.00 | | |
| August 14, 1876 | 175,000.00 | | |
| June 18, 1878 | 300,000.00 | | |
| Do | 50,000.00 | | Harbor of refuge at or near Cincinnati. |
| March 3, 1879 | 250,000.00 | | |
| June 14, 1880 | 250,000.00 | | |
| March 3, 1881 | 350,000.00 | | |
| March 21, 1882 | 100,000.00 | | Continuiug work on Davis Island dam. |
| August 2, 1882 | 350,000.00 | | |

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[a] Amount appropriated by deficiency act July 1, 1902, improving Ohio River between Cairo and Mound City, $25,000, undrawn and not included in amount available.

*Statement of amounts and dates of all appropriations for this work*—Continued.

| Act of Congress. | Appropriation. | Allotment. | Remarks. |
|---|---|---|---|
| August 2, 1882 | $16,000.00 | | Harbor of refuge near Cincinnati, Ohio. |
| July 5, 1884 | 600,000.00 | | |
| Do | 17,000.00 | | Do. |
| August 5, 1886 | 375,000.00 | | |
| August 11, 1888 | 380,000.00 | | |
| September 19, 1890 | 300,000.00 | | |
| January 19, 1891 | 2,128.87 | | Relief of Stubbs & Lackey. Treasury settlement No. 2598. |
| July 13, 1892 | 360,000.00 | | |
| August 18, 1894 | 250,000.00 | | |
| June 3, 1896 | 250,000.00 | | |
| July 1, 1898 | | $15,000.00 | For restoring levee and banks of Ohio River at or near Shawneetown, Ill. |
| March 3, 1899 | 375,000.00 | | |
| June 13, 1902 | 359,000.00 | | Amount appropriated, $400,000, $41,000 being for Falls of Ohio River, at Louisville, Ky. |
| July 1, 1902 | 25,000.00 | | Between Cairo and Mound City. |
| Total | 6,590,608.12 | 352,000.00 | |

| | | |
|---|---|---|
| Total of appropriations, 1827-1904 | $6,590,608.12 | |
| Total of allotments, 1827-1898 | 352,000.00 | |
| Received from sales, 1866-1904 | 7,997.78 | |
| Received from Treasury settlement, 1904 | 261.45 | |
| | | $6,950,867.35 |
| Appropriations not drawn, 1827, 1852 | 5,023.47 | |
| Appropriation not drawn, 1902 (between Cairo and Mound City) | 25,000.00 | |
| Allotments not drawn, 1866, 1868 | 43,134.60 | |
| Returned by Treasury settlements | 30.07 | |
| Amount transferred to other works | 125,168.44 | |
| | | 198,356.58 |
| Total | | 6,752,510.77 |

LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Formal contracts.*

*Hire of towboat and crew as tender to United States dredges.*—The Smiley Towboat Company, June 4, 1903; approved June 12, 1903; to commence when ordered; terminate about December 1, 1903; towboat discharged December 3, 1903.

*Hire of towboat and crew as tender to United States dredges.*—New Haven Towboat Company, May 26, 1904; approved June 7, 1904; to commence when ordered; terminate about December 1, 1904.

*Emergency contracts.*

*Hire of one flatboat.*—S. N. Galbreath, June 4, 1903; commence within ten days after receipt of order; terminate when discharged; discharged December 8, 1903.

*Hire of one flatboat.*—S. N. Galbreath and Amos White, June 4, 1903; commence within ten days after receipt of order; terminate when discharged; discharged December 8, 1903.

*Hire of three flatboats.*—Oscar F. Barrett, June 5, 1903; commence within ten days after receipt of order; terminate when discharged; discharged December 5, 1903.

*Hire of towboat.*—B. J. Riggs, June 5, 1903; commerce within ten days after receipt of order; terminate when discharged; discharged December 8, 1903.

*Hire of dredge.*—Kanawha and Ohio Company, June 10, 1903; commence within ten days after receipt of order; terminate when discharged; discharged December 5, 1903.

*Iron and steel.*—Wm. T. Johnston Company, June 15, 1903; commence in ten days; terminate in thirty days; completed July 23, 1903.

*Dynamite, exploders, etc.*—Hercules Powder Company, June 15, 1903; commence when ordered; terminate December, 1903; completed November 5, 1903.

*Cement.*—The Atlas Portland Cement Company, June 18, 1903; commence in ten days; terminate when entire quantity required is delivered; completed November 17, 1903.

*Hire of towboat.*—Venus Towboat Company, September 21, 1903; commence when ordered; terminate when discharged; discharged November 29, 1903.

*Stone for Maysville ice pier.*—October 3, 1903; commence within ten days after receipt of order; terminate in thirty days; completed November 21, 1903.

*Reconstructing three dump scows.*—The Monongahela River Consolidated Coal and Coke Company, February 12, 1904; commence within ten days after date of signature of contract; terminate two months from date of receipt of the old scows; completed May 18, 1904.

## STAGES OF OHIO RIVER IN 1903.

The following are the records of the gauges at Pittsburg, Cincinnati, and Evansville, which may be taken to represent the navigable condition of the upper, middle, and lower Ohio:

### *Gauge at Davis Island dam, near Pittsburg, Pa.*

[When the dam is up, low-water readings must be obtained from the gauge at the lower end of the lock. On this gauge 3 feet 2 inches corresponds to a navigable depth of 3 feet, and 6 feet corresponds to the same depth in the river.]

| Month. | Depth in channel. | | | Gauge readings. | |
|---|---|---|---|---|---|
| | Under 3 feet. | 3 feet and over. | 6 feet and over. | Highest. | Lowest. |
| 1903. | *Days.* | *Days.* | *Days.* | *Feet.* | *Feet.* |
| January | 0 | 31 | 25 | 14.9 | 5.4 |
| February | 0 | 28 | 28 | 22.0 | 6.9 |
| March | 0 | 31 | 31 | 24.9 | 7.5 |
| April | 0 | 30 | 28 | 18.4 | 5.6 |
| May | 7 | 24 | 2 | 7.0 | 2.7 |
| June | 0 | 30 | 13 | 10.6 | 3.0 |
| July | 0 | 31 | 28 | 15.2 | 4.8 |
| August | 8 | 23 | 6 | 8.3 | 2.4 |
| September | 5 | 25 | 4 | 8.8 | 2.8 |
| October | 5 | 26 | 5 | 8.7 | 2.4 |
| November | 9 | 21 | 7 | 11.3 | 2.9 |
| December | 0 | 31 | 8 | 8.4 | 3.0 |
| Total | 34 | 331 | 185 | .......... | .......... |

### *Cincinnati gauge.*

[The zero of this gauge is about 2 feet below low water. Readings of about 4 feet correspond to about 3 feet in the channel, and those of 7 feet to about 6 feet in the channel.]

| Month. | Depth in channel. | | | Gauge readings. | |
|---|---|---|---|---|---|
| | Under 3 feet. | 3 feet and over. | 6 feet and over. | Highest. | Lowest. |
| 1903. | *Days.* | *Days.* | *Days.* | *Feet.* | *Feet.* |
| January | 0 | 31 | 31 | 37.0 | 14.7 |
| February | 0 | 28 | 28 | 49.4 | 23.2 |
| March | 0 | 31 | 31 | 53.1 | 26.2 |
| April | 0 | 30 | 30 | 44.4 | 22.8 |
| May | 0 | 31 | 31 | 23.0 | 7.6 |
| June | 0 | 30 | 30 | 17.7 | 10.3 |
| July | 0 | 31 | 31 | 17.1 | 9.3 |
| August | 0 | 31 | 21 | 9.1 | 5.0 |
| September | 0 | 30 | 27 | 14.3 | 5.1 |
| October | 0 | 31 | 18 | 11.7 | 4.5 |
| November | 0 | 30 | 10 | 16.5 | 4.5 |
| December | 0 | 31 | 28 | 22.8 | 5.8 |
| Total | 0 | 365 | 316 | .......... | .......... |

### *Evansville gauge.*

[The zero of this gauge is about at low-water line. Readings of 2 feet correspond to about 3 feet in the channel, and readings of 6 feet correspond to about 6 feet in the channel.]

| Month. | Depth in channel. | | | Gauge readings. | |
|---|---|---|---|---|---|
| | Under 3 feet. | 3 feet and over. | 6 feet and over. | Highest. | Lowest. |
| 1903. | *Days.* | *Days.* | *Days.* | *Feet.* | *Feet.* |
| January | 0 | 31 | 31 | 29.6 | 18.1 |
| February | 0 | 28 | 28 | 40.7 | 18.1 |
| March | 0 | 31 | 31 | 42.3 | 26.7 |
| April | 0 | 30 | 30 | 36.0 | 21.9 |
| May | 0 | 31 | 31 | 20.9 | 6.4 |
| June | 0 | 30 | 30 | 18.4 | 8.1 |
| July | 0 | 31 | 31 | 12.5 | 7.2 |
| August | 0 | 31 | 15 | 8.6 | 3.8 |
| September | 0 | 30 | 8 | 9.0 | 3.4 |
| October | 1 | 30 | 4 | 6.8 | 2.9 |
| November | 8 | 22 | 4 | 10.0 | 2.4 |
| December | 0 | 31 | 11 | 8.5 | 3.2 |
| Total | 9 | 356 | 254 | .......... | .......... |

## STAGES OF THE OHIO RIVER.

*Highest, lowest, and average stages of the Ohio River at Cincinnati each calendar year from 1860 to 1903, inclusive, with the highest stage during the floods of 1832 and 1847.*

| Calendar year. | Highest stage. | | Lowest stage. | | Average for the year. |
|---|---|---|---|---|---|
| | Month. | Stage. | Month. | Stage. | |
| | | *Feet.* | | *Feet.* | *Feet.* |
| 1832 | February | 64.2 | .......... | .......... | .......... |
| 1847 | December | 63.6 | .......... | .......... | .......... |
| 1860 | April | 49.2 | October | 5.3 | 16.0 |
| 1861 | .....do | 49.4 | July | 5.1 | 19.1 |
| 1862 | January | 57.3 | October | 2.3 | 17.4 |
| 1863 | March | 42.7 | .....do | 2.5 | 15.0 |
| 1864 | December | 45.1 | August | 3.1 | 16.7 |
| 1865 | March | 56.2 | October | 5.7 | 21.8 |
| 1866 | September | 42.5 | August | 4.7 | 19.2 |
| 1867 | March | 55.7 | October | 3.0 | 17.0 |
| 1868 | .....do | 48.2 | July | 5.1 | 18.7 |
| 1869 | April | 48.7 | August | 5.3 | 19.7 |
| 1870 | January | 55.2 | October | 3.3 | 17.8 |
| 1871 | May | 40.5 | .....do | 2.7 | 11.8 |
| 1872 | April | 41.7 | .....do | 3.0 | 11.7 |
| 1873 | December | 44.4 | .....do | 3.7 | 18.4 |
| 1874 | January | 47.9 | September | 2.3 | 15.7 |
| 1875 | August | 55.3 | .....do | 4.2 | 18.7 |
| 1876 | January | 51.7 | .....do | 6.2 | 18.2 |
| 1877 | .....do | 53.7 | October | 3.2 | 15.0 |
| 1878 | December | 41.3 | .....do | 4.3 | 16.7 |
| 1879 | .....do | 42.7 | .....do | 2.5 | 14.5 |
| 1880 | February | 53.1 | .....do | 3.7 | 17.0 |
| 1881 | .....do | 50.6 | September | 1.9 | 16.9 |
| 1882 | .....do | 58.6 | November | 6.1 | [a] 22.1 |
| 1883 | .....do | 66.3 | September | 3.6 | [a] 19.5 |
| 1884 | .....do | 71.0 | .....do | 2.7 | [a] 17.3 |
| 1885 | January | 46.0 | .....do | 2.5 | [a] 15.6 |
| 1886 | April | 55.7 | November | 3.3 | [a] 17.8 |
| 1887 | February | 56.2 | September | 2.7 | [a] 15.1 |
| 1888 | April | 39.9 | August | 5.2 | [a] 17.9 |
| 1889 | February | 38.2 | September | 5.2 | [a] 18.5 |
| 1890 | March | 59.2 | August | 5.7 | [a] 25.7 |
| 1891 | February | 57.3 | October | 4.4 | [a] 20.5 |
| 1892 | April | 43.7 | November | 3.4 | [a] 16.5 |
| 1893 | February | 54.9 | August | 3.6 | [a] 17.7 |
| 1894 | .....do | 35.6 | September | 3.1 | [a] 12.9 |
| 1895 | January | 48.4 | October | 2.3 | [a] 12.2 |
| 1896 | April | 47.8 | September | 5.5 | [a] 16.7 |
| 1897 | February | 61.2 | October | 3.1 | [a] 16.5 |
| 1898 | March | 61.4 | .....do | 4.5 | [a] 19.7 |
| 1899 | .....do | 57.4 | November | 3.4 | 17.1 |
| 1900 | December | 40.0 | October | 3.2 | 13.8 |
| 1901 | April | 59.7 | November | 4.2 | 17.6 |
| 1902 | March | 50.9 | September | 3.9 | 16.8 |
| 1903 | .....do | 53.1 | October, November. | 4.5 | 17.9 |

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[a] Prepared from the stages as shown by the waterworks marks daily at 6 a. m. and 6 p. m., the previous and succeeding years having been made from one daily observation at 6 a. m.

*Commerce of Ohio River in 1903*—Continued.

| Name of boat or company. | Terminal points. | Distance. | In commission. | Freight. | Passengers. |
|---|---|---|---|---|---|
| | | *Miles.* | *Months.* | *Tons.* | |
| Steamer Pioneer City | Marietta to Williamstown | 1.0 | 11.0 | 50,000 | 65,000 |
| C. D. Dotson | Lock 18 to Parkersburg | 10.0 | 3.0 | 375,000 | .......... |
| Collins & Hartweg Co | Parkersburg to Louisville | 414.0 | 12.0 | 395,329 | .......... |
| Venus Towboat Co | .....do | 414.0 | 7.0 | 40,160 | .......... |
| Steamer Nina Paden | Parkersburg to Belpre | 1.0 | 11.6 | 24,000 | 140,000 |
| Steamer Katie Mc | Ravenswood to Cincinnati | 249.0 | 5.0 | 5,400 | 650 |
| Steamer W. O. Hughart | Graham to Racine | 1.0 | 11.0 | 1,500 | 20,000 |
| Kanawha and Ohio Co | Syracuse to Louisville | 354.0 | 9.0 | 361,403 | .......... |
| Syracuse Coal and Salt Co | Syracuse to Cincinnati | 224.0 | 9.0 | 17,617 | .......... |
| Steamer Klondike | Syracuse to Gallipolis | 24.0 | 11.0 | 600 | 5,625 |
| Big Sandy Towboat Co | Pomeroy to mouth Green River | 525.0 | 12.0 | 234,749 | .......... |
| Convoy Towboat Co | Pomeroy to Louisville | 349.0 | .......... | 62,800 | .......... |
| B. J. Malone & Co | Pomeroy to Cincinnati | 219.0 | 4.0 | 24,000 | .......... |
| Cincinnati, Portsmouth, Big Sandy, and Pomeroy Packet Co. | .....do | 219.0 | 11.5 | 103,761 | 26,389 |
| Steamer Champion No. 3 | Pomeroy to Mason | 1.0 | 12.0 | 15,000 | 75,000 |
| Steamer Otto Marmet | Point Pleasant to Louisville | 334.0 | 12.0 | 122,080 | .......... |
| Marmet Co | Point Pleasant to Cincinnati | 204.0 | 12.0 | 328,800 | .......... |
| Steamer Chevalier | Point Pleasant to Huntington | 43.0 | 10.0 | 4,032 | 10,560 |
| Steamer Neva | Point Pleasant to Gallipolis | 5.0 | 11.0 | 9,250 | 13,200 |
| Steamer Carrie Brown | Gallipolis to Huntington | 39.0 | 8.0 | 2,560 | 24,750 |
| Steamer Champion No. 2 | Gallipolis to Steinbergen Landing. | 1.0 | 10.0 | 8,000 | 25,900 |
| Steamer Greyhound | Proctorville to Portsmouth | 51.0 | 11.0 | 11,000 | 18,480 |
| Steamer Arion | Proctorville to Guyandotte | 1.0 | 11.0 | 14,000 | 16,000 |
| C. Crane & Co | Huntington to Louisville | 291.0 | 12.0 | 120,000 | .......... |
| Steamer Bonne | Catlettsburg to South Point | 1.0 | 12.0 | 90,000 | 7,000 |
| Steamer Lucy Coles | Ashland to Portsmouth | 33.0 | 12.0 | 6,986 | .......... |
| Steamer Bob Ballard | Ashland to Ironton | 5.0 | 12.0 | 341,115 | .......... |
| Steamer Wenona | Ashland to Coal Grove | 1.0 | .......... | .......... | 182,500 |
| Steamer Ironton | Ironton to Russell | 1.0 | 12.0 | 23,292 | 122,896 |
| Steamer B. F. Bennett | Portsmouth to Fullerton | 2.0 | 12.0 | 800 | 4,000 |
| Steamer Old Reliable | Rockport to Evansville | 43.0 | 12.0 | 23,205 | 400 |
| Steamer W. H. Whiteman | Manchester to South Manchester. | 1.0 | 12.0 | 10,360 | 38,680 |
| Steamer Proctor K. Smiley | Ripley to South Ripley | 1.0 | 12.0 | 3,478 | 15,000 |
| Steamer Whisper | Augusta to Bonds Ferry | 1.0 | 10.0 | 20,000 | 9,009 |
| B. J. Riggs | Moscow to Cincinnati | 27.0 | 8.0 | 250,312 | .......... |
| Steamer Lotus | New Richmond to Louisville | 150.0 | 3.0 | 1,100 | 48 |
| Steamer New Richmond | New Richmond to South New Richmond. | 1.0 | 12.0 | 3,553 | 19,020 |
| Coney Island Co | Coney Island to Cincinnati and excursions. | 9.0 | 3.5 | 900 | 555,099 |
| Smith Coal and Sand Co | Dayton to Addyston | 17.0 | 11.0 | 69,000 | .......... |
| Steamer Avalon | Cincinnati to Cairo | 498.0 | 3.0 | 4,154 | 1,442 |
| John Barrett & Son | .....do | 498.0 | 7.0 | 35,800 | .......... |
| Huntington and St. Louis Towboat Co. | .....do | 498.0 | 12.0 | 80,700 | .......... |
| Steamer Lula E. Warren | .....do | 498.0 | 11.0 | 22,000 | 5,000 |
| A. Montgomery & Co | .....do | 498.0 | 2.0 | 11,550 | .......... |
| Memphis and Cincinnati Packet Co. | .....do | 498.0 | 6.0 | 4,100 | 1,095 |
| Steamer E. T. Slider | Cincinnati to Evansville | 316.0 | 12.0 | 263,572 | .......... |
| Louisville and Cincinnati Packet Co. | Cincinnati to Louisville | 130.0 | 12.0 | 153,395 | 132,654 |
| Steamer Mildred | .....do | 130.0 | 8.0 | 4,000 | .......... |
| Steamer Levi J. Workum | Cincinnati to Madison | 85.0 | 9.0 | 46,870 | 2,998 |
| Steamer Frank Miller | .....do | 85.0 | 12.0 | 108,750 | .......... |
| Steamer Al. Martin | Cincinnati to Carrollton | 73.0 | 1.0 | 3,000 | .......... |
| Steamer Boone No. 5 | Cincinnati to Constance | 7.0 | 11.5 | 18,400 | 16,380 |
| Steamer Swan | Aurora to Patriot | 21.0 | 11.0 | 350 | 2,200 |
| Steamer Minnie | Patriot to Madison | 39.0 | 12.0 | 4,827 | 15 |
| Steamer Eva Evartt | Vevay to Ghent | 1.0 | 12.0 | 100 | 17,520 |
| Louisville and Jeffersonville Ferry Co. | Carrollton to Leavenworth | 117.0 | 12.0 | .......... | 901,106 |
| Steamer Falls City | Carrollton to Louisville | 57.0 | 12.0 | 17,000 | 70,033 |
| Steamer White Dove | Carrollton to Madison | 12.0 | 11.0 | 1,550 | 2,300 |
| Robert Hornbrook | Madison to Paducah | 367.0 | 10.0 | 313,000 | 47,537 |
| Steamer Alma | Louisville to Cairo | 367.0 | 9.0 | 16,474 | 625 |
| Steamer Little Willie | .....do | 367.0 | 12.0 | 58,135 | .......... |
| Louisville and Evansville Packet Co. | Louisville to Henderson | 196.0 | 10.5 | 150,560 | 25,178 |
| Kentucky and Indiana Bridge and Railroad Co. | Louisville to West Point | 26.0 | 6.0 | .......... | 22,448 |
| The Marsden Co | Cloverport to Henderson | 89.0 | 10.0 | 11,544 | 1,090 |
| W. D. Crammond | Cannelton to Owensboro | 32.0 | 10.0 | 7,890 | 8,748 |
| Steamer Wabash | Rockport to Paducah | 180.0 | 12.0 | 15,570 | 5,275 |
| Steamer Henderson | Newburg to Uniontown | 68.0 | 12.0 | 1,400 | 7,275 |
| Archbold Coal Co | Newburg to Henderson | 25.5 | 12.0 | 61,390 | 2,452 |

*Commerce of Ohio River in 1903*—Continued.

| Name of boat or company. | Terminal points. | Distance. | In commission. | Freight. | Passengers. |
|---|---|---|---|---|---|
| | | *Miles.* | *Months.* | *Tons.* | |
| Steamer Neptune | Mouth Green River to Smithland. | 133.0 | 9.0 | 21,141 | |
| Steamer Edgar | Mouth Green River to Mount Vernon. | 44.5 | 10.0 | 45,000 | |
| Evansville and Bowling Green Packet Co. | Mouth Green River to Evansville. | 8.0 | 11.0 | 40,820 | 10,500 |
| Green River Mining Co | do | 8.0 | 12.0 | 500 | |
| Steamer Kenois | do | 8.0 | 4.0 | 5,000 | |
| Chas. McNutt | do | 8.0 | 5.0 | 155,000 | 20 |
| Steamer Peter Hontz | do | 8.0 | 10.0 | 2,000 | 150 |
| Steamer Ruth | Evansville to Cairo | 182.0 | 9.0 | 7,024 | |
| Steamer Racket | Evansville to Paducah | 137.0 | 8.0 | 43,000 | |
| Steamer J. F. Buckham | do | 137.0 | 10.0 | 25,000 | |
| Evansville, Paducah, and Cairo Line. | do | 137.0 | 11.5 | 28,765 | 25,490 |
| Nashville and Evansville Packet Co. | Evansville to Smithland | 125.0 | 7.0 | 12,000 | 3,000 |
| Steamer New Haven | Evansville to Elizabethtown | 94.0 | 12.0 | 3,000 | 1,800 |
| Steamer Alfred D. Owen | Evansville to Shawneetown | 65.0 | 9.0 | 8,000 | 8,500 |
| Steamer Jewell | Evansville to Henderson | 11.0 | 11.0 | 36,000 | 85,000 |
| Illinois Central Railway Co | Majors to McClain | 1.0 | 12.0 | 300,193 | 34,196 |
| Steamer Mary F. Golden | Mouth Wabash River to Paducah. | 82.0 | 5.0 | 88,000 | |
| Steamer John S. Summers | Shawneetown to Cairo | 117.0 | 12.0 | 33,000 | |
| Ayer and Lord Tie Co | do | 117.0 | 9.0 | 201,000 | |
| Ohio Valley Coal and Mining Co. | Shawneetown to Paducah | 72.0 | 12.0 | 24,578 | |
| Steamer Georgie | Shawneetown to opposite shore. | 1.0 | 12.0 | 1,470 | 11,035 |
| Steamer Ten Broeck | Caseyville to Paducah | 60.0 | 1.0 | 2,000 | |
| United States Gas, Coal, and Coke Co. | do | 60.0 | 12.0 | 152,000 | |
| Steamer Monie Bauer | do | 60.0 | 8.0 | 12,500 | |
| O. F. Keeler & Sons | Smithland to Cairo | 57.0 | 12.0 | 7,500 | |
| Dan Finnie | Smithland to Joppa | 28.0 | 12.0 | 60,285 | |
| Aberdeen Coal and Mining Co. | do | 28.0 | 11.0 | 58,420 | |
| St. Louis and Tennessee River Packet Co. | Paducah to Cairo | 45.0 | 12.0 | 91,583 | 9,030 |
| Steamer Carrie V | do | 45.0 | 12.0 | 40,808 | 50 |
| Steamer Lyda | Paducah to Joppa | 16.0 | 7.0 | 87,500 | |
| Steamer Geo. H. Cowling | Paducah to Metropolis | 9.0 | 12.0 | 4,055 | 42,010 |
| Illinois Central Railway Co | Puducah to Brookport | 3.0 | 6.0 | 161,330 | 26,712 |
| Total | | | | 12,499,842 | 4,286,081 |

*Coal shipments from Pittsburg, Pa., during the calender year 1903*

[Furnished by J. Frank Tilley.]

| From Pittsburg, Pa., to— | Tons. |
|---|---|
| Cincinnati | 1,160,756 |
| Louisville | 546,293 |
| Evansville | 12,870 |
| Paducah | 11,606 |
| Mouth of river | 1,382,922 |
| Total | 3,114.447 |

## REPORT OF MR. R. R. JONES, CHIEF ASSISTANT ENGINEER, ON REMOVING ROCK BAR AT MOUTH OF LICKING RIVER, KENTUCKY (468.4 MILES BELOW PITTSBURG; SURVEYS 1896–1900).

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, June 30, 1904.*

COLONEL: I have the honor to submit the following report of operations in removing Rock bar at mouth of Licking River for the fiscal year ending June 30, 1904.

The work was carried on by drilling and blasting with Government plant and hired labor, and with dredge, towboat, and flatboats hired under contract by the day, from August 1 to November 7, when the work of blasting the solid rock in the channel, as originally proposed, was completed and the crew of the drill boat was discharged, except sufficient men to operate one drill during the progress of dredging the remaining blasted material, should occasion require the blasting of any rock found above grade.

Dredging was continued until December 5, when all the blasted material, etc., so far as could then be determined, had been removed from the channel and the dredge was discharged.

During the fiscal year ending June 30, 1904, 4,089 cubic yards of solid rock were drilled and blasted, and 19,576 cubic yards of blasted rock, loose rock, sand, and gravel were dredged from channel, towed to Culloms Ripple, and deposited behind the dike at that point.

Tabulated statements of the work accomplished and the cost of same are appended hereto.

*Statement of solid rock blasted by use of steam drills and submarine charges since this method was first adopted.*

| Fiscal year ending June 30— | Cubic yards. |
|---|---|
| 1894 | 892.20 |
| 1895 | 2,082.68 |
| 1896 | 2,736.00 |
| 1902 | 2,572.00 |
| 1903 | 4,564.00 |
| 1904 | 4,089.00 |
| Total | 16,935.88 |

*Statement of the total material (solid rock, loose rock, gravel, and sand) removed since the work was first undertaken.*

| | Cubic yards. |
|---|---|
| By open cut in cofferdam, fiscal years ending June 30, 1888 and 1892 | 3,619.6 |
| By blasting solid rock and by dredging the rock, gravel, and sand, fiscal years ending June 30, 1894, 1895, 1896, 1902, and 1903 | 64,550.1 |
| By blasting solid rock and by dredging the rock, gravel, and sand, fiscal year ending June 30, 1904 | 19,576.0 |
| Total | 87,745.7 |

Eighty-seven thousand seven hundred and forty-five and seven-tenths cubic yards, barge measurement, of material of all kinds (solid rock, loose rock, gravel, and sand), equivalent to 65,813.27 cubic yards, solid measurement, have been removed since the work was first begun (season of 1887) at a total cost of $142,748.99—an average cost of $2.169 per cubic yard.

*Summary of holes drilled, etc.*

| | Number of holes drilled and blasted. | Total depth. |
|---|---|---|
| Fiscal year ending June 30— | | *Feet.* |
| 1894 | 832 | 2,441.6 |
| 1895 | 1,194 | 4,859.9 |
| 1896 | 1,958 | 7,212.3 |
| 1902 | 1,259 | 5,020.0 |
| 1903 | 3,694 | 12,675.0 |
| 1904 | 2,584 | 9,787.4 |
| Total | 11,521 | [a] 41,996.2 |

[a] Equivalent to 7.95 miles.

Average depth of holes, 3.6451 feet.

The cost of the work, exclusive of inspection, office expenses, etc., during the fiscal year ending June 30, 1904, was $3.05 per cubic yard.

Prior to the approval (April 1, 1899) of the subproject of March 20, 1899, a total of $63,750 had been expended on this work. Since the approval of this subproject, $78,998.99 has been expended during the seasons of 1901, 1902, and 1903, and the average cost per cubic yard during this period was $3.21, exclusive of inspection, office expenses, etc.

*Comparative statement of cost.*

| | Per cubic yard. |
|---|---|
| Lowest proposal (October 31, 1901) | $3.82 |
| Cost during seasons of 1901, 1902, and 1903 | 3.21 |

*Various items of cost for fiscal years ending June 30, 1902, 1903, and 1904.*

| | | Quantity. | Value. |
|---|---|---|---|
| Dynamite: | | | |
| No. 1 | pounds | 5,300 | $2,675.75 |
| No. 2 | do | 14,875 | |
| Exploders, insulated | number | 8,450 | 1,666.89 |
| Muslin for wrappers | yards | 1,050 | 61.59 |
| Twine for making up cartridges | pounds | 124 | 24.20 |
| Rubber tubing for insulating joints | feet | 2,000 | 57.00 |
| Connecting and leading wire | pounds | 78½ | 49.98 |
| Total for explosives, etc | | | 4,535.41 |
| Fuel | | | 310.12 |
| Extraordinary repairs to drill boat | | | 8,166.85 |
| Ordinary repairs | | | 591.15 |
| Supplies of all kinds | | | 1,429.68 |
| Expenses of all kinds | | | 775.45 |
| Labor and inspection | | | 8,659.21 |
| Office salaries | | | 1,905.50 |
| Total cost drilling and blasting | | | 26,373.37 |

*Cost of dredging, including towing and unloading dredged material, fiscal years ending June 30, 1902, 1903, and 1904.*

| | |
|---|---|
| Dredge, hired under proposals | $16,759.38 |
| Flatboats, hired under proposals | 11,648.30 |
| Towboat, hired under proposals | 10,149.17 |
| Labor unloading dredged material | 7,596.53 |
| Inspection and miscellaneous expense | 2,685.24 |
| Office salaries | 3,787.00 |
| Total | 52,625.62 |
| Total cost of the work, seasons 1901, 1902, 1903 | 78,998.99 |

*Summary of cost of the work for seasons of 1901, 1902, and 1903.*

| | |
|---|---|
| 11,225 cubic yards of solid rock drilled and blasted, costing $26,373.37, average cost per cubic yard | $2.349 |
| 57,881 cubic yards (barge measurement), equivalent to 43,420.47 cubic yards, solid measurement, of material dredged, towed to Culloms Ripple and unloaded, costing $52,625.62, average cost per cubic yard | 1.212 |
| Total cost per cubic yard | 3.561 |
| Less cost of inspection, etc | .351 |
| Average cost per cubic yard | 3.210 |

Starting slightly within the mouth of the Licking River, the channel curves out into the Ohio to nearly the axis of the river at ordinary stages. The width of the channel increases gradually, and, taking the entire length, it will average about 200 feet, with a depth of not less than 4 feet at extreme low (1881) water.

It is proposed to make a careful examination of the new channel during the present season, to determine whether any loose rock has been washed down from above or whether any small quantities of blasted rock remain to be taken out.

Such work can best be done during the low-water period, which usually occurs in September or October.

During the fiscal year ending June 30, 1904, the work was under the immediate supervision of Mr. Clinton B. Harris, junior engineer, assisted by Mr. Frank C. Stout, inspector, on the second or night turn at dredging.

Respectfully submitted.

R. R. Jones,
*Chief Assistant Engineer.*

Col. G. J. Lydecker,
*Corps of Engineers.*

## REPORT OF MR. R. R. JONES, CHIEF ASSISTANT ENGINEER, ON REPAIRS TO DIKES AND DAMS IN THE OHIO RIVER.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, June 30, 1904.*

COLONEL: I have the honor to submit the following report of operations in connection with repairs to dikes and dams in the Ohio River during the fiscal year ending June 30, 1904:

General repairs to dikes and dams were carried on during the low-water season under project dated July 9, 1902, approved July 28, 1902.

After the abandonment of the project to construct an ice pier at Harris Ferry, W. Va., the stone which had been procured for this work was towed to Belleville Island, 4.4 miles below Harris Ferry, and to Newberry Island, 5 miles above Harris Ferry, and used in the repair of dams at these points.

### BELLEVILLE ISLAND DAM (203 MILES BELOW PITTSBURG).

The riprap dam, built in 1844 to close the back channel of Belleville Island, is 1,100 feet in length and was originally built up to a 6-foot stage. The action of the swift water in the narrow chute at the head of the back channel had partly destroyed this dam, the connection of the dam with the island shore being entirely effaced. Repairs by renewing the stone were begun September 14, and the work of restoring the dam to a 6-foot stage was completed October 10, 723.7 cubic yards of loose stone being placed in the dam.

This dam at the close of the season of 1903 was in very good condition and it was then believed that it would perform useful service for many years to come. It is proposed, however, to make a careful examination of the dam during the coming low-water season to determine what injury, if any, was caused by the heavy ice which prevailed for an unusually long period during the winter of 1903-4.

### NEWBERRY ISLAND DAM (193.6 MILES BELOW PITTSBURG).

The riprap dam at this point was also constructed in 1844, to close the back channel of Newberry Island. It is 1,650 feet in length and was originally built up to a 6-foot stage. This dam was badly broken and did not connect with the island shore. The work of renewing the stone which had been displaced was commenced October 12 and completed to about a 4-foot stage November 6, 2,015.7 cubic yards of looee stone being placed in the dam.

It is believed that the dam should be restored to about its original height, viz, 6 feet above low water, as soon as funds shall become available for such work. It is thought that about 2,000 cubic yards of material will be required to complete the work, the estimated cost of such completion being $4,000.

It is proposed to make a careful examination of the dam during the approaching low-water season.

A statement showing the material used and the cost of repairs to the dams at Newberry and Belleville islands, is given below.

*Items of cost incurred in repairing dams at Belleville and Newberry islands.*

| | |
|---|---|
| Stone, 2,739.4 cubic yards, at $1.80 | $4,930.92 |
| Hire of towboat and barges | 1,227.20 |
| Incidental expenses | 68.63 |
| Labor and inspection | 964.30 |
| Total cost | 7,191.05 |

Average cost per cubic yard, $2.62½.

The work was carried on directly by the United States with hired labor, and towboat, barges, etc., hired under proposal by the day, while the stone was purchased in open market after advertisement.

### EIGHT MILE DIKE (455.5 MILES BELOW PITTSBURG).

The timber crib dike at this point was built in 1886, and is 2,300 feet in length, built up to an 8-foot stage; original cost, $37,506.11. The timbers in this dike have rotted badly in places, allowing the stone filling to escape. The work of repairs was begun November 16 and suspended December 5 on account of high water and cold weather.

Statements showing material used in repairs, cost, and an estimate of material, labor, etc., required to complete the repairs are given below:

*Material placed in dike, season of 1903.*

| | | |
|---|---|---|
| Oak timbers | feet B. M.. | 11,140 |
| Driftbolts | pounds.. | 1,403 |
| Stone | cubic yards.. | 70 |

*Items of cost of repairs, season of 1903.*

| | | |
|---|---|---|
| Oak timbers | 11,140 feet B. M.. | $445.60 |
| Driftbolts | 1,403 pounds.. | 38.98 |
| Stone | 70 cubic yards.. | 77.00 |
| Hire of barges | | 144.50 |
| Labor and inspection | | 189.00 |
| Total | | 895.08 |

*Estimate of material, labor, etc., to complete repairs to Eight Mile dike.*

| | | |
|---|---|---|
| Oak timbers | 23,400 feet B. M.. | $936.00 |
| Driftbolts | 2,020 pounds.. | 60.60 |
| Towing and barge hire | | 217.00 |
| Labor | | 398.79 |
| Total | | 1,612.39 |

The work of repairs to Eight Mile dike was carried on directly by the United States by hired labor, hire of barges by the day, the material being procured under proposals.

The cost of repairs to dike at Eight Mile, as stated in above estimate, is based on the condition of the dike when last examined (low-water season of 1903); but it is proposed to make a careful examination of the dike during the approaching low-water season to determine what injury, if any, was caused by the heavy ice which prevailed during the winter of 1903–4.

The work of repairs to dikes and dams during the season of 1903 was in local charge of Mr. C. W. Lewis, inspector.

### UPPER, MIDDLE, AND LOWER FOUR MILE DIKES.

Situated at a distance of from 3 to 4½ miles below the foot of the Eight Mile dike are three other timber crib dikes; the original cost of these dikes was as follows:

| | Cost. |
|---|---|
| Upper Four Mile dike | $34,022.13 |
| Middle Four Mile dike | 39,458.61 |
| Lower Four Mile dike | 50,719.61 |
| Total | 124,200.35 |

An examination of these dikes was made during the low-water season of 1903 and an estimate made of the cost of such repairs as would replace the decayed or otherwise damaged parts of the top of each dike; such estimate is herewith appended.

*Estimated cost of repairs to Upper Four Mile dike.*

| | | |
|---|---|---|
| Oak timbers | 38,800 feet B. M.. | $1,552.00 |
| Driftbolts | 3,888 pounds.. | 116.64 |
| Stone | 200 cubic yards.. | 400.00 |
| Towing and hire of barges | | 217.00 |
| Labor | | 660.59 |
| Total | | 2,946.23 |

*Estimated cost of repairs to Middle Four Mile dike.*

| | |
|---|---|
| Oak timbers, 35,800 feet B. M | $1,432.00 |
| Driftbolts, 3,936 pounds | 118.08 |
| Stone, 200 cubic yards | 400.00 |
| Towing and hire of barges | 217.00 |
| Labor | 609.61 |
| Total | 2,776.69 |

*Estimated cost of repairs to Lower Four Mile dike.*

| | |
|---|---|
| Oak timbers, 17,400 feet B. M | $696.00 |
| Driftbolts, 1,830 pounds | 54.90 |
| Stone, 200 cubic yards | 400.00 |
| Towing and hire of barges | 217.00 |
| Labor | 296.79 |
| Total | 1,664.69 |

*Summary.*

| | |
|---|---|
| Complete repairs to Eight Mile dike | $1,612.39 |
| Repairs to Upper Four Mile dike | 2,946.23 |
| Repairs to Middle Four Mile dike | 2,776.69 |
| Repairs to Lower Four Mile dike | 1,664.69 |
| Total estimated cost of repairs | 9,000.00 |

It is believed that the maintenance of these dikes is required in the interests of navigation, and it is recommended that repairs be made whenever funds for such purpose shall become available.

Respectfully submitted.

R. R. JONES,
*Chief Assistant Engineer.*

Col. G. J. LYDECKER,
*Corps of Engineers.*

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## REPORT OF MR. R. R. JONES, CHIEF ASSISTANT ENGINEER, ON THE CONSTRUCTION AND REBUILDING OF ICE PIERS IN THE OHIO RIVER.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, June 30, 1904.*

COLONEL: I have the honor to submit the following report in connection with the construction and rebuilding of certain ice piers in the Ohio River during the fiscal year ending June 30, 1904.

### HOCKINGPORT, OHIO, 198.6 MILES BELOW PITTSBURG.

The project for constructing an ice pier at or near the mouth of Big Hocking River, dated July 8, was approved July 31, 1902.

Work of setting up machinery, arranging for delivery of supplies, storing cement, constructing forms for the placing of concrete, building earthen embankment around foundation base of piers, etc., was carried on until August 14, when all work was ordered suspended on account of objections raised to the building of the pier. A public hearing was held in this office August 13, and a record of this hearing, together with your recommendation that the project be abandoned, was transmitted to the Chief of Engineers August 27. By recommendation, concurred in by the Chief of Engineers and approved by the Secretary of War September 5, the project was thereupon abandoned.

The stone which had been contracted for was used in the repairs to loose stone dams at the head of Newberry Island and Belleville Island, respectively; the plant, cement, lumber, etc., which had been procured for the work was loaded on barges and shipped to Maysville, Ky., for use in ice-pier construction at that point.

The total amount expended in the preliminary work and the purchase of material, etc., for the ice pier at Big Hocking was $4,390.95.

### MAYSVILLE, KY., 407.4 MILES BELOW PITTSBURG.

The project for this work was dated July 9 and approved July 28, 1902.

Owing to failure to procure relinquishment of riparian rights from the owners of one piece of property involved in the site originally determined upon for the location of pier, a second examination and survey, including soundings and borings, was entered upon and continued during July and August. The result of these investigations, together with the expressed views and wishes of parties who had interests in the river at Maysville, and of owners of towboats operating in this locality, was the selection of a new site for the pier at a point about 450 feet below the original location.

Timber, stone, cement, etc., were purchased under proposals and the work was carried on by hired labor employed directly by the United States. On September 23 a force of men was started to work cutting and framing the timbers for the foundation cribs. On September 27 a dredge boat was engaged to clear off the river bottom for the placing of foundation cribs, the bottom being dredged level to a depth equal to 10.5 feet below low water. Work of placing and sinking the three foundation cribs (each 28 by 59 feet) was completed October 27, after numerous delays caused by high water and failure to receive promptly shipments of timber and stone. Laying concrete was begun October 23 and suspended for the season November 28, on account of high stage of water and cold weather. The three sections of pier were carried to a height of about 13 feet above low water. The plant, tools, etc., were stored and the force discharged December 5.

The greater depth of water and the character of the material which composed the bed of the river at the new site necessitated the removal of a larger amount of loose material and a proportional increase in the quantities of timber and stone in the foundation cribs.

The greater depth of water about the cribs, while a positive advantage to navigation interests after the completion of the ice pier, obliged some changes to be made in the manner of conducting the work of construction. Among other things, it required the hire of more flatboats on which to handle the material and from which to put it in place. By careful management the unit price of the stone and concrete filling was kept at a low rate, but yet was somewhat higher than those of the original estimate; the quantities, however, were increased for the reasons already stated.

A comparison of the estimated cost of cribs at site first selected and the actual cost at the site on which cribs were constructed is given below. The necessity for change in site has already been stated, viz: Failure to acquire relinquishment of the riparian rights at the site originally proposed.

*Comparative statement of cost of pier.*

| | Cost of original site. | Cost as constructed. |
|---|---|---|
| Foundation cribs: | | |
| Borings | (a) | $310.24 |
| Clearing bottom (dredging) | $950.00 | 1,600.00 |
| Timber cribs (including ironwork, labor, etc.) | 2,889.00 | 5,097.76 |
| Rough stone and concrete filling (including all material, labor, etc.) | [b] 3,340.00 | [c] 7,428.00 |
| Cost of three crib foundations | 7,179.00 | 14,436.00 |
| Superstructure, carried up to a stage of 13 feet; concrete and rough stone, including all material and labor, 1,120 cubic yards, at $5.65½ | | 6,333.85 |
| Total | | 20,769.85 |

[a] None contemplated. [b] 1,620 cubic yards, at $2.06. [c] 2,883 cubic yards, at $2.64¼.

The three sections of the pier require to be built up to heights varying from 20.5 feet to 26.5 feet greater than at present to bring them to the heights originally proposed. The estimated cost of this work (the cost per cubic yard of which will increase as the height increases and sectional area diminishes) is $9,065. The balance of funds available under the original appropriation for the construction of an ice pier at Maysville, Ky., is not sufficient to complete the work. It is therefore respectfully suggested that authority be obtained to use so much of the funds originally allotted for the construction of ice pier at or near the mouth of Big Hocking River (work on which has been abandoned, in accordance with indorsement of the War Department of September 5, 1903) for the completion of the ice pier at Maysville, Ky.

The ice pier at Maysville, Ky., proved to be most valuable in the protection of floating craft during the severe winter of 1903-4, and, so far as can be learned, has been very acceptable to the river interests.

A statement of the material placed in the pier during the season of 1903 is appended hereto.

The construction of the pier was carried on under the supervision of Messrs. Clinton B. Harris and Frank A. Bone, junior engineers.

*Material placed in pier during season of 1903.*

FOUNDATION CRIBS.

| | | |
|---|---|---|
| Oak timbers, 10 by 12 inches | feet B. M. | 108,160 |
| Poplar lumber, 2 by 12-14 inches | do | 6,744 |
| Yellow pine, 2 by 12-14 inches | do | 2,500 |
| Driftbolts | pounds | 10,743 |
| Cast washers | do | 100 |
| Machine bolts | do | 190 |
| Rough stone | cubic yards | 2,576 |
| Crushed stone | do | 257 |
| Sand | do | 190 |
| Portland cement | barrels | 560 |

SUPERSTRUCTURE.

| | | |
|---|---|---|
| Portland cement | barrels | 840 |
| Crushed stone | cubic yards | 386.70 |
| Rough stone | do | 713.86 |
| Sand | do | 416.98 |
| Iron nosing | pounds | 3,800 |
| Iron mooring rings | do | 800 |
| Iron anchor plates | do | 85 |

GALLIPOLIS AND MIDDLEPORT.

Project dated July 8, approved July 21, 1902. No work was done during fiscal year ending June 30, 1904. It is proposed to begin work on these piers during the coming season.

Respectfully submitted.

R. R. JONES,
*Chief Assistant Engineer.*

Col. G. J. LYDECKER,
*Corps of Engineers.*

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REPORT OF MR. E. J. CARPENTER, ASSISTANT ENGINEER, ON WORK OF THE OHIO RIVER DREDGES DURING THE CALENDER YEAR 1903.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, June 30, 1904.*

COLONEL: I have the honor to submit the annual report of operations of U. S. dredges *Ohio* and *Oswego* for the calendar year 1903, with tabular statements showing cost, amount of excavation, etc., at the various places where dredging was done.

The dredges remained in winter quarters in the Kentucky River at Carrollton until April 12, when they were brought to Cincinnati for the repairs necessary to refit them after the previous season's work on cemented gravel excavation.

The dredge machinery was readily put in order, but the four dump scows were found to be so badly rotted that it was necessary to rebuild about one-half the bins, sides, and decks to make them at all serviceable, these extensive repairs requiring so much time that the plant was not ready for work until June 15.

*Twin Creek bar, 372.4 miles below Pittsburg.*—On completion of the repairs the dredges proceeded to this point to straighten and widen the channel by cutting away the points of the creek bars that projected into it from both sides of the river.

The bar on the Kentucky side, gravel and sand, was removed nearly to the line of low water above and below it, and the opposite rocky bar on the Ohio side was dredged off in such manner as to make a straight channel down to the lower crossing.

The width of the area dredged is 325 feet and the extreme length 2,050 feet, making a straight channel through the ripple 5 to 6 feet deep at low water except on the right, where, for a width of 30 feet, the depth is 3 feet below low water.

The greater part of the bar on right of the channel consists of bowlders and broken stone, extremely compact, making difficult excavation and causing much delay from accidents to the dredge machinery.

The material removed was dumped on and above the creek bar on the Ohio shore, where it serves to direct the river current into the new channel.

*Excavation made, June 18 to September 1.*

| | | |
|---|---|---|
| Gravel and sand | cubic yards.. | 20,508.0 |
| Gravel, bowlders, and loose rock | do.... | 56,103.0 |
| Logs and snags removed (4) | tons.. | 5.4 |
| Rocks removed (1) | do.... | 1.3 |

*Manchester Island, 393 miles below Pittsburg.*—One coal barge wreck, which blocked the towboat channel at this place, was broken up and removed by the dredge *Ohio* on June 26; and a second barge, sunk later near the same point, was destroyed and taken out by the dredge on July 25.

Wrecks removed, coal barges, 2.

*Sand Creek bar, 220 miles below Pittsburg.*—After finishing their work at Twin Creek the dredges were moved to this place, where the narrow, crooked channel had long interfered with navigation, and had caused much loss to coal tows.

Work at Sand Creek, in the low water season, was made possible by a rise which enabled the dredges to make an outlet in the channel through which scows could reach the dumping ground during low water. The length of the ripple and distance to the dumping ground made two towboats necessary to tend the dredges, and low water seriously interfered with the work; but on the whole a fair rate of progress was made. The channel was widened by dredging off the gravel bar on the right; and at foot of the ripple, near the dike, a gravel lump was removed that had heretofore made the place almost impassable for ascending boats and tows during the lower stages of river.

The dredging added 160 feet to the width of channel, with depth 4 to 5 feet below low water, for a length of 2,700 feet, and 225 feet width, with 6 feet low-water depth for an additional distance of 1,000 feet, the total length widened being 3,700 feet; easy passage for coal tows, as well as packets, being thus assured.

Most of the material excavated, which consisted of gravel and sand with some hard clay and occasionally a crust of cemented gravel, was dumped behind the dike on the West Virginia shore at the foot; but a small portion, taken from the upper end of the bar, was placed below the rock bar on the Ohio shore, opposite the Ravenswood wharf.

On November 28, after the fourth through cut had been completed, work for the season was stopped on account of cold weather, which had already caused considerable delay.

*Excavation made, September 9 to November 28.*

| | | |
|---|---|---|
| Gravel and sand | cubic yards.. | 95,303.0 |
| Logs and snags removed (3) | tons.. | 3.5 |
| Rocks removed (10) | do.... | 23.4 |

On November 29 the dredging plant left Ravenswood, W. Va., for winter quarters in the Little Kanawha River at Parkersburg; but, owing to an accident that disabled the machinery of one of the hired towboats and to delays from heavy ice in the river, did not reach Parkersburg until December 2, when the remaining dredge tender was discharged.

Arrangements had been made to dock the dredge *Oswego* on arrival at Parkersburg, to replace the ash well which had rusted through, and to stop some leaks about the head of the hull where a number of rivets had been loosened by the hard work of the past three seasons. As this work could not be done during the severely cold weather, and as the old scows were all leaking badly, it was necessary to retain more than the usual number of (two) men to take care of the plant.

On December 5 the crews, with exception of six men needed to take care of the plant, were furloughed and sent home.

* * * * * * *

When cold weather compelled suspension of operations, last November, the plant was taken to winter quarters in the Little Kanawha River at Parkersburg, W. Va., with the expectation of docking the *Oswego* to renew the ash well, which had rusted through, and to replace a number of loose rivets that caused dangerous leaks at the forward end of the hull. Owing, however, to the severe and long-continued cold weather, it was not possible to dock the dredge until April 3; and on the 15th, immediately after coming off the docks, the dredge hull was cut by collision with the steamer *French*, necessitating further repairs, for which redocking was required, and which were not completed until May 10.

While the dredges were in winter quarters it was necessary for their safety to keep one of the crews to take care of them, as both the Ohio River and the Little Kanawha were frozen from late in November till early in March, but these men were utilized, as far as conditions would permit, to make some of the repairs needed to fit the plant for the ensuing season's work.

As the dump scows were all unfit for use, the woodwork of three of them being quite worn out and rotten, and the fourth in need of extensive repair, an emergency contract was made with the Monongahela River Consolidated Coal and Coke Company to rebuild three of the scows for $3,889.32 each, using such of the metal parts, trusses, shafts, door fittings, etc., as were in good order; and this work was completed by the contractors promptly and in a most satisfactory manner.

The fourth scow and one of the decked flats were docked, calked, and partly repaired at Parkersburg, and on May 18 the plant was moved to Marietta, Ohio, to complete refitting for the season's work.

Proposals for furnishing a towboat for dredge tender during the present season were opened May 5, and the lowest bid, that of the New Haven Towboat Company, of Spilman, W. Va., $44.64 per day, was accepted.

On June 11 the repairs of the dredges having been completed, and three of the scows, the number required for the two dredges when working with single towboat for tender, being ready for service, the plant left Marietta to begin the season's operations.

The *Oswego* began work immediately after the dredges reached Coon Run; but as the bar proved too short for both dredges to work there at once, the *Ohio's* crew was employed in completing repairs of the fourth scow until the 21st, when, an extra towboat having been procured, the *Oswego* was taken to Fish Creek Island, 2 miles above, and the *Ohio* continued work at Coon Run.

*Coon Run bar, 114.9 miles below Pittsburg.*—This bar consists of gravel, bowlders, and loose rock carried out into the river by the run, making a sharp, high point, which extended more than 500 feet from shore line and caused much trouble to packets and danger to tows at ordinary stages of river.

Five cuts have been made, widening the channel 200 feet, the area dredged, 5 feet below low water, having this width at the point of the bar, and extreme length of 600 feet.

The excavated material has been dumped close to the Ohio shore opposite and above the bar.

*Excavation made, June 14 to 30.*

| | | |
|---|---|---|
| Gravel, bowlders, and loose rock | cubic yards.. | 17,130.0 |
| Rocks removed (3) | tons.. | 4.8 |

Work in progress.

*Blair Run bar, Ohio, opposite Fish Creek Island, 113 miles below Pittsburg.*—This bar, composed of bowlders and rock from the run, projects into the river from the Ohio shore abreast of the island, causing so sharp a turn in the channel that during stages when navigation is comparatively easy at other places in this part of the river, it is difficult and dangerous at this point.

Four cuts have been made, with depth of 5 feet below low water, widening the channel 120 feet at the point of the bar and extending for a length of 800 feet.

The material excavated has been dumped on left of the channel close to Fish Creek Island, just above the foot, where it will serve to prevent scour along the island and will direct the current into the channel.

*Excavation made, June 22 to 30.*

| | | |
|---|---|---|
| Gravel, bowlders, and loose rock | cubic yards.. | 8,793.0 |
| Rocks removed (1) | tons.. | 3.4 |
| Logs removed (2) | do... | 2.0 |

Work in progress.

Respectfully submitted.

E. J. CARPENTER,
*Assistant Engineer.*

Col. G. J. LYDECKER,
*Corps of Engineers.*

### OHIO RIVER DREDGING STATEMENT FOR 1903.

### *Dredges in commission.*

### TIME.

| Time at work. | Days. | Time lost. | Days. |
|---|---|---|---|
| Dredging gravel and sand | 56.5 | Sundays | 24.0 |
| Dredging gravel, bowlders, and loose rock | 28.1 | Holidays | 3.0 |
| Removing logs and snags | .4 | Traveling | 7.0 |
| Removing rocks | .4 | Coaling | 4.0 |
| Removing wrecks | 2.0 | High water | 16.0 |
| | | Accidents | 25.6 |
| Total | 87.4 | Total | 79.6 |

Total in commission, 167 days.

### WORK.

| Nature of work. | Per day of work. | During the season. |
|---|---|---|
| | *Cu. yds.* | *Cu. yds.* |
| Gravel and sand excavated | 2,049.8 | 115,811.0 |
| Gravel, bowlders, and loose rock excavated | 1,996.5 | 56,103.0 |
| Total excavation for the season | | 171,914.0 |
| | Number. | Tons. |
| Logs and snags removed | 7 | 8.9 |
| Rocks removed | 11 | 24.7 |
| Wrecks removed | 2 | |

### COST.

| | |
|---|---|
| Equipment for the season | $1,208.67 |
| Towing and fuel for the season | 11,448.14 |
| Repairs for the season | 1,133.05 |
| Salaries for the season | 8,226.92 |
| Total for the season | 22,016.78 |

### *Dredges out of commission.*

### TIME.

| | Days. |
|---|---|
| In ordinary | 135 |
| Annual repairs | 63 |
| Total | 198 |

### COST.

| | | |
|---|---|---|
| Salaries in ordinary | $2,959.23 | |
| Towing, wharfage, etc., in ordinary | 62.00 | |
| Total in ordinary | | $3,021.23 |
| Salaries during annual repairs | 4,635.11 | |
| Annual repairs (shop bills, materials, etc.) | 1,861.99 | |
| Total cost of repairs | | 6,497.10 |
| Total out of commission | | 9,518.33 |
| Cost per day in ordinary (including superintendent's pay) | | 22.38 |

*Cost of work, including all expenditures in 1903.*

| | |
|---|---|
| Dredging gravel and sand | $20,385.97 |
| Dredging gravel, bowlders, and loose rock | 10,138.85 |
| Removing wrecks | 721.63 |
| Removing logs and snags | 144.33 |
| Removing rocks | 144.33 |
| Total expenditure in 1903 | 31,535.11 |

*Cost per unit.*

| | |
|---|---|
| Per cubic yard of excavation | $0.178 |

The day of work is for eight hours actual operation of two dredges with four dump scows and one or two towboats for tenders, deducting every hour lost by accident or otherwise.

The towboat *Catherine Davis*, chartered as dredge tender, was paid $49.50 per day, this amount covering the cost of the boat, with outfit, crew, and fuel for the towboat and dredges, except that all cost of coal in excess of 5 cents per bushel was repaid by the Government.

The expenditure for towing includes $2,350 for hire of additional dredge tender found necessary to dispose of the excavated material when a low stage of river prevented access to the near dumping grounds.

The "total expenditure," on which the cost of work is based, covers all outlay properly applicable to the season of 1903, including the cost of superintendence, office work, etc.

*Location and description of work.*

| Place. | Miles from Pittsburg. | Date—1903. | Days of work. | Logs and snags. | | Rocks. | |
|---|---|---|---|---|---|---|---|
| | | | | No. | Tons. | No. | Tons. |
| Twin Creek bar | 372.4 | June 18–July 20 | 10.2 | | | | |
| Do | 372.4 | June 19–Sept. 1 | 28.1 | | | | |
| Do | 372.4 | June 19–July 14 | .2 | 4 | 5.4 | | |
| Do | 372.4 | Aug. 18 | .1 | | | 1 | 1.3 |
| Manchester Island | 393.0 | June 26–July 25 | 2.0 | | | | |
| Sand Creek bar | 220.0 | Sept. 9–Nov. 28 | 46.3 | | | | |
| Do | 220.0 | Sept. 10–Oct. 5 | .2 | 3 | 3.5 | | |
| Do | 220.0 | Sept. 10–Nov. 16 | .8 | | | 10 | 23.4 |
| Total | | | 87.4 | 7 | 8.9 | 11 | 24.7 |

| Place. | Number of wrecks. | Gravel and sand. | Gravel, bowlders, and loose rock. | Per day of work. | Cost per cubic yard. | Total for 1903. |
|---|---|---|---|---|---|---|
| | | *Cubic yards.* | *Cubic yards.* | *Cubic yards.* | | |
| Twin Creek bar | | 20,508 | | 2,010.6 | $0.179 | $3,680.30 |
| Do | | | 56,103 | 1,996.5 | .181 | 10,138.85 |
| Do | | | | | | 72.17 |
| Do | | | | | | 36.08 |
| Manchester Island | 2 | | | | | 721.63 |
| Sand Creek bar | | 95,303 | | 2,058.4 | .175 | 16,705.67 |
| Do | | | | | | 72.16 |
| Do | | | | | | 108.25 |
| Total | 2 | 115,811 | 56,103 | | | 31,535.11 |

## D D 2.

## CONSTRUCTION OF LOCK AND DAM NO. 37, OHIO RIVER.

The general project for this work is printed in House Document No. 336, Fifty-seventh Congress, first session, and it was adopted by Congress in the river and harbor act of June 13, 1902, by appropriating

$100,000 for commencing operations and authorizing their completion under the continuing-contract system at a total cost not exceeding $1,050,000.

Previous operations, including local surveys incident to selection of the site finally adopted for the work, at Fernbank, Ohio, 12.7 miles below the Cincinnati Suspension Bridge, are published in the Annual Report of the Chief of Engineers for 1903, page 1645.

Operations during the last fiscal year were confined to the acquisition of lands necessary for the improvement, and to the preparation of detailed plans and specifications for the work. The land acquired comprises two tracts—one of 4.09 acres on the left, or Kentucky, bank of the river for the abutment of the dam, and the other of 32.9 acres on the right, or Ohio, bank where the lock and all buildings required for operating the lock and dam will be located. The smaller tract was acquired by direct purchase from its owner at a cost of $654.40, and clear title therefor passed to the United States by deed dated December 8, 1903. But it was necessary to resort to condemnation proceedings in order to obtain the larger tract at a reasonable cost, as well as to dispose of conflicting interests between the fee owner and lessee of the property. On account of the delays incident to these proceedings it was not until March 23, 1904, that the United States was put in possession of this tract by order made in the United States court for the southern district of Ohio. The sum awarded by the court was $4,935, and payment therefor was duly made to the clerk of the court for distribution to the parties in interest in conformity with the court's orders. Since that time the detailed plans and specifications have been practically completed, and they will reach the office of the Chief of Engineers within a few days after this report is received there.

The local supervision of this work is in charge of Mr. R. R. Jones, chief assistant engineer, whose report is herewith.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $487,872.94 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 11,041.33 |
| July 1, 1904, balance unexpended | 476,831.61 |
| July 1, 1904, outstanding liabilities | 136.63 |
| July 1, 1904, balance available | 476,694.98 |
| Amount (estimated) required for completion of existing project | 550,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 150,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

STATEMENT OF AMOUNTS AND DATES OF ALL APPROPRIATIONS FOR THIS WORK.

| | |
|---|---|
| Act of Congress— | |
| June 13, 1902 | $100,000 |
| March 3, 1903 | 400,000 |
| Total | 500,000 |

wrecking apparatus, $35.43; pilot house, kitchen, and pantry, $25.66; new rudder and its dock, $342.35; total, $2,007.12.

In addition to the work reported above, several wrecks occurred during the year, which endangered navigation and demanded immediate removal when the *Woodruff* was too far distant or was undergoing repairs, and was consequently not available. Under these conditions Inspector S. H. Fowler fitted out the U. S. steam launch *Wenonah* at Davis Island dam, and removed the following wrecks in the vicinity of Pittsburg: One coal barge 1 mile above the dam, 1 coal barge and the remains of another near the head of Logstown bar, 1 coal boat at Merrimans Ripple and 1 at Deadmans Island, 1 model barge at McKees Rocks, and completed work on the remains of the steamer *Elizabeth*, most of which had been previously removed by the *Woodruff;* and with hired steamboats in February, 1904, when heavy ice prevented the use of the launch, removed 2 coal barges and 1 coal boat at the Steubenville Bridge, and in April 1 coal barge at Grape Island.

At Rising Sun, Ind., a serious obstruction directly in the channel proved on examination to be the remains of two barges (originally loaded with steel rails) about which a bar had formed in such a way as to entirely obliterate the natural channel. As the snag boat was then engaged in urgent work on the upper river, the hired dredge in use on the removal of blasted rock at Licking bar was transferred to this point August 27, 1903, and by September 4, with a double crew working sixteen hours per day, had removed 267 large timbers, 11.5 cords broken timbers, 9 steel rails, and 4,250 yards gravel, clearing the channel of all obstruction at this locality.

In my annual reports for the years 1902 and 1903 I expressed the opinion that if two light-draft steamboats were added to the plant pertaining to the general improvement of the Ohio River they would, among other purposes related to that work, be of very great utility as substitutes for the *Woodruff* during low-water periods, and this opinion has been amply confirmed by the experience of the year just closed.

*List of steamboat wrecks, by name, removed from the Ohio River during the fiscal year ending June 30, 1904, by the U. S. snag boat E. A. Woodruff.*

| Name. | Location. | Miles below Pittsburg. |
|---|---|---|
| Elizabeth | Jacks Run | 3.5 |
| R. A. Speed | Foot of Tennessee Island | 920.0 |
| Jennie Gilchrist | Cairo, Ill | 963.0 |

*Summary of expenditures for operating snag boats on Ohio River for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Office expenses and superintendence | $5,695.00 |
| Service | 15,651.51 |
| Subsistence | 4,699.61 |
| Fuel | 3,333.73 |
| Explosives, etc | 1,019.08 |
| General supplies and expenses | 1,700.11 |
| Care and repair of plant | 2,590.32 |
| Hire of dredge, steamboats, and flats | 1,540.47 |
| Total | 36,229.83 |

## D D 4.

## BRIDGES OVER OHIO RIVER IMPEDING SAFE AND CONVENIENT NAVIGATION.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, December 22, 1903.*

GENERAL: Under date of September 18, 1903, I submitted to the Department a list of bridges over the Ohio River which are, in my opinion, impediments to safe and convenient navigation, the duty of preparing this list and other related information called for by the river and harbor act of June 13, 1902, having been assigned to me by the Chief of Engineers.

That list has been slightly revised since it was originally prepared, and the following is now submitted as a substitute for it:

### (A) BRIDGES WITH CHANNEL SPANS LESS THAN 500 FEET.

*Beaver Bridge (Pittsburg and Lake Erie Railway), 25.3 miles below Pittsburg, Pa.*—Channel span 426 feet, with clear height of 45.5 feet above highest water and 88.9 feet above low water; built in 1878 under act of Congress approved December 17, 1872.

Losses due to collision with piers reported as $73,740.

*Steubenville Bridge (Pittsburg, Cincinnati, Chicago and St. Louis Railway), 66.2 miles below Pittsburg, Pa.*—Channel span 303 feet, with clear height of 42 feet above highest water and 89.6 feet above low water; built in 1862–63 under act of Congress approved July 14, 1862.

Losses due to collision with piers reported as $122,358.

*Bellaire Bridge (Baltimore and Ohio Railway), 94.1 miles below Pittsburg, Pa.*—Principal channel span 322 feet, with clear height of 38.9 feet above highest water and 90 feet above low water, and a contiguous "through" or channel span of 213.8 feet at same elevation; built in 1871–72 under act of Congress approved July 14, 1862.

Losses due to collision with piers reported as $150,126.

*Parkersburg Bridge (Baltimore and Ohio Railway), 183.7 miles below Pittsburg, Pa.*—Principal channel span, 326.5 feet, with clear height of 38 feet above highest water and 90 feet above low water, and a contiguous "through" or channel span of 326.5 feet at same elevation; built in 1870–71, under act of Congress approved July 14, 1862.

Losses due to collision with piers reported as $110,348.47.

*Point Pleasant Bridge (Kanawha and Michigan Railway), 264.3 miles below Pittsburg, Pa.*—Channel span, 400 feet, with clear height of 30.9 feet above highest water and 91.4 feet above low water; built in 1882–1886, under act of Congress approved December 17, 1872.

Losses due to collision with piers reported as $9,660.

*Newport and Cincinnati Bridge (railway and highway), 467.9 miles below Pittsburg, Pa.*—Channel span, 490 feet, with clear height of 33 feet above highest water and 102.2 feet above low water; originally built in 1871–72, under acts of Congress approved July 14, 1862, and March 3, 1869, and rebuilt in 1895–1897, with increased present channel span.

River bridges from 300 to 500 feet, but nearly twenty-one years have now passed without further extension of the 500-foot minimum that was established by the act of February 14, 1883. In this interval commerce, and the size of tows and towboats engaged in it, have so increased as to require considerably more channel room at the passage of bridges, while the science of bridge construction has so advanced in the meantime that a span of 750 feet in now as feasible, practically, as one of 500 feet was in 1883. These facts appear to be generally conceded by parties who have recently sought authority to erect bridges over the Ohio, judging from the applications that have passed through this office and been acted upon by the Secretary of War during the last three years; the number of applications was eight, and the widths of channel span as originally proposed by applicant, together with the widths finally required by the Secretary of War, are shown in the following statement:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Proposed by applicant | 520; | 563; | 630; | 650; | 650; | 700; | 750; | 800 feet |
| Required by Secretary of War | 700; | 650; | 700; | 750; | 700; | 700; | 750; | 800 feet |

It is also to be observed that the locations of all these bridges are between Pittsburg, Pa., and Marietta, Ohio, and none of them in the wider portion of the river below.

In addition to furnishing a list of bridges which are impediments to safe and convenient navigation, the river and harbor act of June 13, 1902, requires the Secretary of War to report (1) the nature and extent of the modifications required in each of them, (2) an estimate of the cost thereof on each bridge, and (3) whether the necessary changes can be secured under existing law, and if not, what legislation is necessary to secure them. I regret to say that the constant pressure of other duties has prevented me, thus far, from obtaining such complete data and information as is required to fully and satisfactorily answer these important questions. For this reason they must be dealt with, for the present, in a somewhat comprehensive and general way, instead of dealing specifically with each and every bridge.

The glaring trouble and cause of complaint in each case is insufficient width of waterway under the main-channel span, coupled in some instances with an unsatisfactory location of that span; that is to say, the towing interests insist that, while safe and convenient navigation of descending fleets demands wider channel spans as the prime consideration, the spans should not be in midstream, but so located that one of its piers shall be a shore pier, or nearly so, when the river is at a favorable coal-boating stage. Reference to the illustrations accompanying this report suggests that these conditions would be satisfied in most instances by substituting a single span for the present channel span and one of the spans adjoining it, and removing the pier that separates the waterway under the two contiguous spans. For example, consider the first bridge in the list above, the Beaver Bridge; its left-hand channel pier is a shore pier, and the substitution of a single span extending from that pier to the second on the right of it would, when the intermediate pier is removed, provide a channel span of about 700 feet. And taking the next in the list, the Steubenville Bridge, the substitution of a single span extending from the present left-hand channel pier to the second one beyond it on the Ohio shore would, with the intermediate pier removed, provide a channel span of about 535 feet with its right-hand pier close to shore at favorable coal-towing stages; it is not unlikely that river interests would urge some further change in this instance, with a view to obtaining a still longer channel span by extending it farther toward the West Virginia shore. Satisfactory results would probably be obtained for the Bellaire Bridge by introducing a single span about 590 feet long as a substitute for the two high spans nearest the Ohio shore, and for the Parkersburg Bridge by replacing the two contiguous 449-foot spans with a single one about 700 feet long, all requirements for safe and convenient navigation would be met; also at the Point Pleasant Bridge by introducing a single span about 650 feet long in place of the second and third existing spans, counting from the Ohio shore. Without stopping to particularize with reference to each of the other bridges it may now be stated, in general, that modifications similar to those above indicated would apply in most instances and provide for safe and convenient navigation; but the specific project for each case that would best harmonize all interests concerned could only be determined upon after extended conference with their representatives and careful study of the various propositions that would undoubtedly be suggested in such conference.

As to the question of cost that may attach to modifications required in these bridges, it is apparent that a precise estimate must depend upon the specific plan that is adopted in each case; for this reason it is impracticable at present to make any detailed or conclusive answer to this feature of the inquiry by Congress, unless it be a purely academic one based on hypothetical or assumed data. Estimates of this character have not been made because no one in my office force who was qualified to make them could be assigned to the duty without taking him from other work that required all his time and attention, and I could not succeed in engaging any expert in bridge estimate and construction to make them at what was considered a proper or justifiable expenditure for the purpoose, the best terms offered, after considerable correspondence and inquiry, being $2,200 for estimate on a single bridge, with a reduction to $1,900 each for four or more bridges; and even this proposition was limited to the stipulations that the contemplated new spans should be of the same strength and capacity as the present ones, and that no improvement to or in either the sub or super structure to provide for the increased loads and traffic of the present day would be considered. The following, however, is an estimate from the records of this office, that was made in 1901 by the chief engineer of the Pittsburg and Lake Erie Railroad Company, for changing their bridge at Beaver in the way heretofore indicated in this report:

| | |
|---|---|
| Weight of steel in new span, 2,550 tons, at $125 per ton | $318,750 |
| 700 linear feet of track, at $3 per foot | 2,100 |
| Raising adjoining spans and trestle girders and raising approaches at each end of the new bridge, on account of increased thickness of floor | 82,000 |
| Taking down three piers, about 9,000 cubic yards, at $5 per yard | 45,000 |
| Building two new piers, about 13,400 cubic yards, at $15, inclusive of foundation work | 201,000 |
| Total | 648,850 |
| Salvage: Old structure removed, 1,000 tons weight, at $40 | 40,000 |
| Net | 608,850 |

The above estimate is without doubt a liberal one for the bridge in question, but from such limited study as I have been able to give to and the nature and extent of the modifications required in each of them, and report the same to Congress, together with information as to whether necessary changes in said bridges, or any of them, can be secured under existing law, and, if not, what legislation is necessary in order to secure proper changes or modifications in said bridges, respectively, and an estimate of the cost thereof on each bridge: *Provided*, That the Attorney-General is authorized and directed to furnish, upon the request of the Secretary of War, an opinion upon the question whether the owners of these bridges, or any of them, can be required, under existing laws, to make the necessary changes at their own expense; and, if further legislation is required, whether by such legislation the owners of such bridges, or any or either of them, can be required to make such changes and modifications at their own expense, or whether such changes or modifications, or any or either of them, must be borne by the United States, which opinion shall accompany the report of the Secretary of War to Congress.

Your communication of February 15, 1904, transmits a report of the Chief of Engineers, containing a list of bridges deemed to be impediments to the safe and convenient navigation of the Ohio River, and requests my opinion upon the questions of law specifically designated in the above provision.

The report of the Chief of Engineers refers to fifteen bridges, giving, among other things, the dimensions of the same, the date of their erection, and the acts of Congress under which they were built. The cost of making the necessary alterations in these structures is estimated at about $600,000 for each bridge.

It is unnecessary to state in detail the facts respecting the construction of each of these bridges. For the purpose of determining the legal questions upon which my opinion is required by the act of June 13, 1902, they may, with certain exceptions, which will be specifically noted, be resolved into two classes:

1. Those erected under the authority of the act of July 14, 1862 (12 Stat., 569), which contained no reservation of power in Congress to alter, amend, or repeal the act so as to prevent or remove obstructions to navigation arising from the construction of bridges thereunder.

2. Those erected under the authority of the acts of December 17, 1872 (17 Stat., 398), and February 14, 1883 (22 Stat., 414), which expressly reserved such right.

1. The act of July 14, 1862, is entitled "An act to establish certain post-roads." Its first section declared the bridge across the Ohio River at Steubenville (one of those referred to in the report of the Chief of Engineers) a lawful structure, provided it was constructed as therein prescribed. Its second section declared said bridge and Holliday's Cove Railroad a public highway and post-road, and authorized the Steubenville and Indiana Railroad Company, chartered by the legislature of the State of Ohio, and the Holliday's Cove Railroad Company, chartered by the State of Virginia, "to complete, maintain, and operate said road and bridge when completed, as set forth in the preceding section, anything in any law or laws of the above-named States to the contrary notwithstanding."

The third section of the act gave general authority for the bridging of the Ohio River above the mouth of the Big Sandy River. It provided as follows:

SEC. 3. That it shall be lawful for any other railroad company or companies, whose line or lines of road may now or shall hereafter be built to the Ohio River, above the mouth of the Big Sandy River, in accordance with the terms of the charter or charters of such company or companies, to build a bridge across said river for the more perfect connection of any such roads and for the passage of trains thereof, under the limitations and conditions hereafter provided.

The fourth section authorized the erection of either a drawbridge or a bridge with continuous and unbroken spans, and contained directions as to how, in either case, the bridge should be built, particularly specifying the height, width, and location of the spans.

The fifth and last section of the act was as follows:

> SEC. 5. That any bridge or bridges erected under the provisions of this act shall be lawful structures, and shall be recognized and known as post-routes, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and munitions of war of the United States, than the rate per mile which the company or companies erecting such bridge may from time to time receive on the balance of their line or lines for such services, and the officers and crews of all vessels, boats, or rafts navigating the said Ohio River are required to regulate the use of said vessels and of any pipes or chimneys belonging thereto, so as not to interfere with the elevation, construction, or use of any of the bridges erected or legalized under the provisions of this act.

As already stated, the act contained no reservation by Congress of power to alter, amend, or repeal it, so as to prevent or remove any obstruction to navigation arising from the construction of bridges under its authority. Such a reservation in an act of this kind is of course only important in its bearing upon the question whether, when the alteration or removal of a bridge is required, the work shall be done at the expense of the Government or of the owner. Without such a reservation, the power of Congress, in the interest of commerce and navigation, to require the removal of such an obstruction would necessarily exist. Even if the relations between Congress and the company erecting a bridge in accordance with the act of July 14, 1862, were contractual, and Congress were restrained, as a matter of law, although it is not expressly so restrained by the Constitution, from violating the obligation of a contract, the property would nevertheless be subject to appropriation under the power of eminent domain. In this respect, a contract or franchise, and the property acquired thereunder, stand upon the same footing as other private property. (*West River Bridge Co.* v. *Dix*, 6 How., 507; *Long Island Water Supply Co.* v. *Brooklyn*, 166 U. S., 685; Cooley's Const. Lim., 6th ed., p. 339.) All private property of whatever nature is liable to be taken for public use, but when so taken just compensation must be made therefor. (*Monongahela Nav. Co.* v. *United States*, 148 U. S., 312; *United States* v. *Lynah*, 188 U. S., 445, 465.)

Nor can any question be raised as to the power of Congress to authorize the construction of bridges over the navigable waters of the United States. As said in *Willamette Iron Bridge Co.* v. *Hatch* (125 U. S., 1, 12), "although, until Congress acts, the States have the plenary power supposed; yet, when Congress chooses to act, it is not concluded by anything that the States, or that individuals by its authority or acquiescence, have done, from assuming entire control of the matter, and abating any erections that may have been made, and preventing any others from being made, except in conformity with such regulations as it may impose. It is for this reason, namely, the ultimate (though yet unexerted) power of Congress over the whole subject-matter, that the consent of Congress is so frequently asked to the erection of bridges over navigable streams. It might itself give original authority for the erection of such bridges when called for by the demands of interstate commerce by land. But in many, perhaps the majority of cases, its assent only is asked, and the primary authority is sought at the hands of the State." (See also *United States* v. *Bellingham Bay Boom Co.*, 176 U. S., 211.)

We come then to the question whether, in the absence of any reservation of such power in the act of July 14, 1862, the owner of a bridge constructed under its authority and in accordance with its terms can be required to make such changes as Congress may deem necessary in the interests of navigation, at his own expense, without compensation.

The answer to this question is, I think, to be found in *Bridge Co.* v. *United States* (105 U. S., 470), although, as Chief Justice Waite in delivering the judgment took care to observe, the court in that case was not called on to determine "what would have been the rights of the company if in the original license no power of future control by Congress had been reserved." But in deciding the case presented—that of an act in which the power of future control by Congress was expressly reserved—the court enunciated principles which seem to control the proposition before us. To demonstrate this clearly, it will be necessary to refer to that case somewhat at length.

By a resolution passed March 3, 1869 (15 Stat., 347), Congress gave its consent to the erection of a bridge over the Ohio River between Cincinnati and Newport by the Newport and Cincinnati Bridge Company, a corporation organized and chartered under the laws of each of those States and authorized by both to construct such a bridge, provided it was built in accordance with the laws of the United States. The resolution referred to provided that the bridge should be built with an unbroken or continuous span of a certain length over the main channel of the river, and comply in all other respects with the conditions and limitations in the act of July 14, 1862, now under consideration. It further provided that the bridge when completed in the manner specified should be deemed a legal structure and post-road. Then followed this reservation:

> But Congress reserves the right to withdraw the assent hereby given in case the free navigation of said river shall at any time be substantially and materially obstructed by any bridge to be erected under the authority of this resolution.

After the passage of this resolution the bridge company began the erection of a bridge in accordance therewith, and expended a large amount of money in the undertaking. Before it was completed, however, Congress passed the act of March 3, 1871 (16 Stat., 572), making other requirements as to its construction. The company complied with the latter act, and, having completed the bridge on the altered plan, brought suit against the United States to recover the increased cost, as the act expressly authorized it to do. The suit was dismissed, and the decree of dismissal was affirmed by the Supreme Court by a vote of five to three, one justice not sitting.

In delivering the opinion of the court, Chief Justice Waite remarked upon the fact that the several acts of Congress in relation to the construction of bridges prior to that of July 25, 1866, contained no reservation of power whatever to alter, amend, or repeal them, and that the reservation in the last-named and subsequent acts, up to the passage of the resolution of March 3, 1869, was simply of a right to alter or amend the act so as to prevent or remove all material obstructions to navigation by the construction of bridges. The peculiar language of the reservation in the resolution of March 3, 1869, he said, was clearly intended to have a special signification (p. 478):

> It had been considered enough before to provide that, "to prevent or remove all material obstructions to navigation," the "right to alter or amend," expressed in the usual form, be reserved. But when power was given to build below the Big Sandy a bridge such as had before only been built above, it was deemed expedient, in the interest of commerce, to be more specific, and by reserving the power to withdraw the assent of Congress to what might prove to be an obstruction to navigation, *to imply at least a reservation of power to make that unlawful which, while the assent continued, would be lawful.*

After referring to the paramount authority of Congress over the subject of bridges across navigable streams, the Chief Justice said (p. 479):

> From this we conclude that the withdrawal by Congress of its assent to the maintenance of the bridge, when properly made, is, for all the purposes of this case, equivalent to a positive enactment that from the time of such withdrawal the further maintenance of the bridge shall be unlawful, notwithstanding the legislation of the several States upon the subject. If modifications are directed, assent is, in legal effect, withdrawn, unless the required changes are made.

The question whether the bridges, as originally authorized, would, if built, substantially and materially obstruct free navigation, was, he said, a legislative and not a judicial question—citing the *Wheeling Bridge cases* (13 How., 518, and 18 How., 421).

Upon the question of compensation, the Chief Justice said (pp. 481–482):

> It is next insisted that, if in the judgment of Congress the public good required the bridge to be removed, or alterations to be made in its structure, just compensation must be made the company for the loss incurred by what was directed. It is true that one can not be deprived of his property without due process of law, and that private property can not be taken for public use without just compensation. In the present case the bridge company asked of Congress permission to erect its bridge. In response to this request permission was given, but only on condition that it might be revoked at any time if the bridge was found to be detrimental to navigation. This condition was an essential element of the grant and the company in accepting the privileges conferred by the grant assumed all risks of loss arising from any exercise of power which Congress saw fit to reserve. *What the company got from Congress was the grant of a franchise, expressly made defeasible at will,* to maintain a bridge across one of the great highways of commerce. This franchise was a species of property, but from the moment of its origin its continued existence was dependent on the will of Congress, and this was declared in express terms on the face of the grant by which it was created. In the use of the franchise thus granted, the company might, and it was expected would, acquire property. The property thus acquired Congress could not appropriate to itself by a withdrawal of its assent to the maintenance of the bridge that was to be built, but the franchise, by express agreement, was revocable whenever, in the judgment of Congress, it could not be used without substantial and material detriment to the interest of navigation. A withdrawal of the franchise might render property acquired on the faith of it, and to be used in connection with it, less valuable, but that was a risk which the company voluntarily assumed when it expended its money under the limited license which alone Congress was willing to give. It was optional with the company to accept or not what was granted, but having accepted, it must submit to the control which Congress, in the legitimate exercise of the power that was reserved, may deem it necessary for the common good to insist upon.

It will be perceived that the conclusion of the court in this case is based entirely upon the ground that the reservation contained in the resolution of March 3, 1869, gave Congress the right "in case the free navigation of said river shall at any time be substantially and materially obstructed by any bridge to be erected under the authority of this resolution," of which contingency it was the judge, by withdrawing its assent to the construction of the bridge, "to make that unlawful which, while the assent continued, would be lawful." This is brought out more distinctly by the dissenting opinions of Mr. Justice Field and

Mr. Justice Bradley. The dissent of Mr. Justice Miller was based upon the construction to be given the act of March 3, 1871, requiring the alterations which he said indicated the purpose of Congress to waive the constitutional question as to its power to change the bridge, and in favor of justice and fair dealing to pay the bridge company for the expense it had incurred, if it was found that the work, as far as it had progressed at the time of the passage of that act, was in conformity to law.

Mr. Justice Field said (105 U. S., 500-501):

I do not think that the assent of Congress to the erection of the bridge was at all essential to its character as a lawful structure. That depended upon the legislation of Kentucky and Ohio, and upon the contingency of the bridge not interfering with the free navigation of the river. The assent of Congress, as already stated, only removed all ground of complaint of the structure as interfering with the public right of navigation, so far as that right was under the protection of the Federal Government. No one could afterwards complain that the bridge, if built in conformity with the directions specified, constituted a public nuisance, because interrupting the free navigation of the river as secured under the laws of Congress, and proceed to obtain its abatement. The authority of the States to build it, coupled with the assent of Congress, if constructed in the manner prescribed, placed the work, whilst in the process of erection and when completed, beyond the reach of legal proceedings for its abatement or modification. It could not, when completed, be taken for public purposes by the General Government, nor be materially changed in its form and structure whilst in the process of erection, under compulsion of the legislation of Congress, without compensation to its owners. The legislative declaration, made when it was nearly completed, that its further construction would be unlawful without a change of plan, which necessitated very costly alterations, or an abandonment of the bridge, was a taking from its owners of a portion of their work as effectually as its absolute appropriation. If not, in the strict constitutional sense, a taking of private property for public uses, it was an enforced expenditure of labor and materials by the company, not required by the work undertaken or the conditions on which assent to its construction had been given; and for such labor and materials the Government should, on every principle of justice, indemnify the company. A legislative decree commanding such an expenditure is within the spirit, if not the letter, of the constitutional provisions which inhibit depriving one of his property without due process of law, and taking it from him without compensation. The wrong inflicted is as great in the one way as in the other. As the provisions were designed to secure the individual from the arbitrary spoliation of his property, their purpose could be readily evaded if a special act could exact for the protection of his property an expenditure of money or labor, which was neither exacted when the property was acquired nor permitted by the terms of its acquisition.

Mr. Justice Bradley was of opinion that (pp. 506-507)—

The bridge as it stood, nearly completed, when the act of March 3, 1871, chapter 121, directing it to be taken down or altered, was passed, was a lawful structure and in the lawful possession of the appellants as their private property, and being such, I think that Congress could not constitutionally require its demolition or reconstruction without providing for compensation to the owners. By virtue of its plenary power to regulate commerce among the several States, as well as with foreign nations, Congress may undoubtedly require the removal of all nuisances and unlawful obstructions in the navigable rivers of the United States without giving compensation to any persons who may be incidentally affected. It also has the power to improve the navigation of such rivers; but in making or authorizing improvements other than the removal of unlawful obstructions, it can not take private property without complying with that clause of the fifth amendment to the Constitution which declares, "Nor shall private property be taken for public use without just compensation." This proposition would be conceded where property taken for that purpose consists of lands, houses, buildings, or other structures standing on the natural banks of a river; but I think that it is equally true where erections are made on the margin of a river, or where a bridge is constructed across it in accordance with the laws of the State and with the consent of Congress. Such structures are lawful and are private property, entitled to the constitutional protection. That which is lawful is not a nuisance, and can not be prostrated or removed as such without compensation.

These expressions make it perfectly clear that the point upon which the court divided was whether Congress had power, under the reservation referred to, by withdrawing its assent to the construction of the bridge, "to make that unlawful which, while the assent continued, would be lawful." The majority thought that it could do so, and therefore the owners of the bridge would not be entitled to compensation for the alterations required. Justices Field and Bradley contended that the lawful character of the bridge was unaffected by the reservation, and therefore compensation for the alterations directed was required. But the entire argument of the majority negatives the proposition that, in the absence of such a reservation, the alteration of the bridge could have been required without compensation to the owners.

What was said by the court in *Monongahela Navigation Company* v. *United States* (148 U. S., 312) sustains this view. In that case the United States sought to appropriate, by condemnation proceedings, a lock and dam in the Monongahela River within the State of Pennsylvania belonging to the navigation company, and which had been constructed by it, in connection with other similar works, under the authority of that State. It was provided in the act of Congress authorizing the condemnation of the property, that in estimating the sum to be paid for it the franchise of the corporation to take tolls should not be considered. The power of the United States to condemn and appropriate the property was conceded, the only question in the case being as to the compensation to be paid therefor.

The court, speaking by Mr. Justice Brewer, held that the franchise of the company to take tolls was a vested right of property, for the taking of which the fifth amendment required just compensation to be made, as well as for the value of the tangible property.

The court distinguished the case of *Bridge Company* v. *United States*, above cited, on the ground that "that was a case not of the taking, but of the destruction of property." After stating the case and quoting therefrom the remarks of the majority upon the question of compensation, above set forth, the court said (pp. 340–341):

> It is evident, therefore, that the point decided was that Congress had reserved the right to withdraw its assent to the construction of a bridge on the plan proposed, whenever, in its judgment, such bridge should become an obstruction to the navigation; that the bridge company entered upon the construction of the bridge in the light of this express reservation, and with the knowledge that Congress might at any time declare that the bridge constructed as proposed was an obstruction to navigation; and that Congress, exercising this reserved power, did not thereby subject the Government to any liability for damages. There was no taking of private property for public uses; and while the company may have been deprived of property, it was deprived by due process of law, because deprived under authority of an express reservation of power. Even this conclusion was reached with strong dissent, Mr. Justice Miller, Mr. Justice Field, and Mr. Justice Bradley dissenting, and each writing a separate opinion. *And those opinions only make more clear the fact that the case was rested in the judgment of the majority on the effect of the reservation.*
>
> In the case at bar there is no such reservation; there is no attempt to destroy property; there is simply a case of the taking by the Government, for public uses, of the private property of the navigation company. Such an appropriation can not be had without just compensation; and that, as we have seen, demands payment of the value of the property as it stands at the time of taking.

The distinction which the court makes in this case between the *taking* and the *destruction* of property has not been maintained. In *United States* v. *Lynah* (188 U. S., 445), following *Pumpelly* v. *Green Bay Company* (13 Wall., 166), the absolute destruction of property was held to be a taking of it within the meaning of the fifth amendment. The opinion in this case was also written by Mr. Justice Brewer. The distinction, however, is immaterial, since in *Monongahela Navigation Company* v. *United States* the court, while viewing the bridge company case as one of the destruction and not of the taking of private property, clearly implies that in the case of such destruction the due process of law provided by the fifth amendment would have required compensation to be made to the owner of the bridge, if the resolution authorizing its construction had not contained the express reservation of power referred to.

It was contended in the case of the Monongahela Navigation Company that the grant made to it by the State was a mere revocable license and had been so held by the courts of Pennsylvania. But the court said that the cases referred to were those in which there was simply a "permit."

In the Pennsylvania cases it was held that a license granted riparian owners by a statute of the State to erect dams for mills and other waterworks in navigable streams declared to be public highways, provided they were so constructed as not to obstruct navigation or prevent fish from passing, was not indefeasible but subordinate to the rights of the public; hence the legislature might constitutionally incorporate a company to make improvements in such a stream without requiring it to make compensation to the owner of a dam for consequential damages thereto from the execution of the work. (*Monongahela Nav. Co.* v. *Coons*, 6 W. & S., 101; *Susquehanna Canal Co.* v. *Wright*, 9 W. & S., 9; *New York & Erie Rd.* v. *Young*, 33 Penn. St., 175.)

In the first Pennsylvania case cited, Chief Justice Gibson observed that "a license followed by a permanent erection for the enjoyment of it is generally irrevocable; and it might be deemed a contract in that instance which the State could not impair." But as the statute there in question provided that dams constructed under its authority should not obstruct navigation, he said that no grant had been made which required a reservation of power to avoid it. Even in that case, one of the judges dissented, on the ground that, while the statute granting the license did not prevent the State from making public improvements, "it puts the dam and mill under the protection of the law, and they can not be taken or destroyed without compensation." (*Monongahela Nav. Co.* v. *Coons*, 6 W. & S., 101, 112, 116.)

From these authorities it is clear that no power to that end having been reserved, the owners of bridges across the Ohio River erected under the authority of the act of July 14, 1862, including the Steubenville bridge referred to in its first two sections, can not be required to alter or modify them at their own expense without compensation. The authority granted by that act can not be termed a "permit" merely; nor is it, as in the Newport and Cincinnati bridge case, "a franchise expressly made defeasible at will." The language of the act suggests permanency. Bridges erected under its authority are declared to be "lawful structures," and to be "recognized and known as post routes. They were not made subject to the interests of navigation, but, on the contrary, those interests were subordinated to them, section 5 providing that "the officers and crews of all vessels, boats, or rafts navigating the said Ohio River are required to regulate the use of said vessels, and of any pipes or chimneys belonging thereto, so as not to interfere with the elevation, construction, or use of any of the bridges erected or legalized under the provisions of this act." This provision was doubtless suggested by the case of the Wheeling bridge, which structure, though afterwards legalized by Congress, had been declared unlawful because it interfered with several large packets with high chimneys then navigating the Ohio. (13 How., 518; 18 How., 421.) The subjection of navigation to a servitude of this kind was, as held in the second Wheeling bridge case, a matter within the discretion of Congress.

The case of *Bridge Company* v. *The United States* (105 U. S., 476) is of course decisive as to the nature of the grant under which the Newport and Cincinnati bridge was originally constructed. It appears, however, from the report of the Chief of Engineers that that bridge was rebuilt in 1895–1897 with its increased present channel span. As held by Attorney-General Griggs, in his opinion in the Bellaire bridge case (22 Opin., 343, 348), if the Newport and Cincinnati bridge was afterwards reconstructed, even though it may be on the same location as the original bridge, the work (in the absence of special legislation, and my attention has been called to none) must have been done, not under the act of July 14, 1862, but under the authority of the act of December 17, 1872, and subsequent legislation, to be presently referred to.

The Ohio Falls bridge was built under the authority of the act of July 14, 1862, and the amendatory act of February 17, 1865 (13 Stat., 431). The latter act authorized certain-named railroad companies to construct a bridge over the Ohio River at the head of the falls of the Ohio, subject to the provisions of the former act, upon certain prescribed conditions as to its height, spans, draws, etc. It also provided "that said bridge and draws shall be so constructed as not to interrupt the navigation of the Ohio River;" and finally declared that "the bridge erected under the provisions of this act shall be a lawful structure, and shall be recognized and known as a post route."

The act of February 17, 1865, contained no reservation of power to alter, amend, or repeal; so that, with the exception of the proviso that "the said bridge and draws shall be so constructed as not to interrupt the navigation of the Ohio River," the situation does not differ from that presented by the act of July 14, 1862, of which it was amendatory.

The meaning and effect of this proviso would seem to be clear. Like the provisions as to the dimensions of the bridge, it is one of the conditions upon which the bridge was authorized to be built and its character as a lawful structure depended. If not built of the required height, width of span, etc., the bridge would be an unlawful structure; and although all other requirements were complied with, if built so as to interrupt the navigation of the river, it would still be unlawful. But *when* constructed in accordance with the prescribed conditions, and so as not to interrupt the navigation of the river, the bridge became, *ipso facto*, as declared in the act a lawful structure. The question whether it was so constructed as not to interrupt the navigation of the river was necessarily to be determined by the requirements of navigation at that time. It could not be made dependent upon the needs of future navigation, without practically annulling the declaration that "the bridge *erected* under the provisions of this act shall be a lawful structure."

It follows therefore that, if the Ohio Falls bridge complied with all the requirements of the acts of July 14, 1862, and February 17, 1865, and did not at the time of its erection interrupt the navigation of the river, the owners thereof can not be required to make such changes therein as the interests of navigation may now demand, at their own expense, without compensation.

2. The act of July 14, 1862, was superseded by the act of December 17, 1872 (17 Stat., 398), entitled "An act to authorize the construction of bridges across the Ohio River, and to prescribe the dimensions of the same." That act provided that "any persons or corporations, having lawful authority therefor, may hereafter erect bridges across the Ohio River, for railroad or other uses, upon compliance with the provisions and requirements of this act" (sec. 1). It also provided that "any bridge constructed under this act, and according to its limitations, shall be a lawful structure, and shall be recognized and known as a post route" (sec. 6).

The act contained, however, this important reservation:

> SEC. 7. That the right to alter or amend this act, so as to prevent or remove all material obstructions to the navigation of said river by the future construction of bridges, is hereby expressly reserved, without any liability of the Government for damages on account of the alteration or amendment of this act, or on account of the prevention or requiring the removal of any such obstructions; and if any change be made in the plan of construction of any bridge constructed under this act, during the progress of the work thereon or before the completion of such bridge, such change shall be subject to the approval of the Secretary of War, and any change in the construction, or any alteration of any such bridge that may be directed at any time by Congress, shall be made at the cost and expense of the owners thereof.

This act was amended in certain respects, which need not be noted, by the act of February 14, 1883 (22 Stat., 414), section 5 of which reserves "the right to alter, amend, or repeal this act as set forth in section 7 of the act hereby amended."

The express reservation contained in these two acts places beyond question the power of Congress to require the alterations of any bridge constructed under their authority, at the cost and expense of the owners thereof, without compensation, in order to prevent or remove all material obstructions to the navigation of said river.

We come then to consider the legislation of Congress applicable to this purpose.

The river and harbor act of March 3, 1899 (30 Stat., 1121, 1153), provides:

> SEC. 18. That whenever the Secretary of War shall have good reason to believe that any railroad or other bridge now constructed, or which may hereafter be constructed, over any of the navigable waterways of the United States is an unreasonable obstruction to the free navigation of such waters on account of insufficient height, width of span, or otherwise, or where there is difficulty in passing the draw opening or the draw span of such bridge by rafts, steamboats, or other water craft, it shall be the duty of the said Secretary, first giving the parties reasonable opportunity to be heard, to give notice to the persons or corporations owning or controlling such bridge so to alter the same as to render navigation through or under it reasonabl free, easy, and unobstructed; and in giving such notice he shall specify the change recommended by the Chief of Engineers that are required to be made, and sha prescribe in each case a reasonable time in which to make them. If at the end such time the alteration has not been made, the Secretary of War shall forthwith notify the United States district attorney for the district in which such bridge is situated, to the end that the criminal proceedings hereinafter mentioned may be taken. If the persons, corporation, or association owning or controlling any railroad or other bridge shall, after receiving notice to that effect, as hereinbefore required, from the Secretary of War, and within the time prescribed by him, willfully fail or refuse to remove the same or to comply with the lawful order of the Secretary of War in the premises, such persons, corporation, or association shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not

exceeding five thousand dollars, and every month such persons, corporation, or association shall remain in default in respect to the removal or alteration of such bridge shall be deemed a new offense and subject the persons, corporation, or association so offending to the penalties above prescribed: *Provided*, That in any case arising under the provisions of this section an appeal or writ of error may be taken from the district courts or from the existing circuit courts direct to the Supreme Court either by the United States or by the defendants.

This section superseded sections 9 and 10 of the act of August 11, 1888 (25 Stat., 424), as amended by sections 4 and 5 of the act of September 19, 1890 (26 Stat., 453), covering the same subject.

There can be no doubt that the authority conferred upon the Secretary of War by section 18 of the act of March 3, 1899, was intended to cover bridges constructed under the authority of acts of Congress, since by preceding sections of the same act provision was made for the case of structures of that nature unauthorized by Congress. (Secs. 9, 10, 12.) The legislation which was superseded by the act of March 3, 1899, also contained similar provisions. (Act of September 19, 1890, secs. 7, 10; 26 Stat., 454; as amended by the act of July 13, 1892, sec. 3; 27 Stat., 110.)

In his opinion in the *Bellaire Bridge case* (22 Opin., 343, 347) Attorney-General Griggs, who took the view above expressed as to the principles to be deduced from the case of *Bridge Company* v. *United States* (105 U. S., 470), was of opinion that section 4 of the act of September 19, 1890, which was superseded by section 18 of the act of March 3, 1899, and which conferred like authority upon the Secretary of War in respect to bridges over the navigable waterways of the United States, would not be sufficient authority to warrant the Secretary of War in requiring changes to be made in the Bellaire bridge, erected under the act of July 14, 1862, at the expense of the owner, without compensation. "The act of 1890," he said, "must be construed to apply only to such bridges as are constructed under the authority of an act of Congress, either the act of 1872 or under a special act, which expressly reserved to Congress the right to require changes or modifications in the structure." The same conclusion must be reached in regard to the act of March 3, 1899. So far, therefore, as the bridges here in question are concerned, this leaves section 18 of that act applicable only to those erected under the acts of December 17, 1872, and February 14, 1883.

Question has been made, however, as to the power of Congress to delegate to the Secretary of War authority to declare that bridges lawfully erected over the navigable waters of the United States are obstructions or unreasonable obstructions to navigation and must be remodeled or removed. In *United States* v. *Keokuk Bridge Company* (45 Fed., 176, 182), District Judge Shiras held that Congress could not do so "without abdicating its paramount and conclusive authority in the regulation of the commercial highways of the country;" and his opinion was adopted by Judge Sage in *United States* v. *Rider* (50 Fed., 406).

The opposite view was taken by Acting Attorney-General J. M. Dickinson in his opinion in the *Moline Bridge case* (21 Opin., 430). In *United States* v. *City of Moline* (82 Fed., 592), which related to the same bridge, Judge Grosscup reached a like conclusion, and in *E. A. Chatfield Co.* v. *City of New Haven* (110 Fed., 788) Judge Shipman expressed his concurrence in Judge Grosscup's opinion.

In my judgment, the latter view—that Congress can constitutionally delegate to the Secretary of War the power in question—is fully supported by the decisions of the Supreme Court.

In *Wisconsin* v. *Duluth* (96 U. S., 379, 383, 387), where certain acts of the Federal Government for the improvement of the harbor at Duluth were in question, the court, speaking by Mr. Justice Miller, said that it was to be observed that "the whole system of river and lake and harbor improvements, whether on the seacoast or on the lakes or the great navigable rivers of the interior, has for years been mainly under the control of that Government, and that, whenever it has taken charge of the matter, its right to an exclusive control has not been denied." "The operations of the Government in this regard," he said, "have been conducted by the Bureau of Engineering, as part of the War Department, to which Congress has confided the execution of its wishes in all these matters." And referring to the acts there in question, he said that there could be no doubt that such action was within the constitutional power of Congress; that it was a power which has been exercised ever since the Government was organized under the Constitution, and that "the only question ever raised has been how far and under what circumstances the exercise of the power is exclusive of its exercise by the States."

In *Miller* v. *Mayor of New York* (109 U. S., 385) it was held competent for Congress to empower the Secretary of War to determine whether a proposed bridge over a navigable water of the United States would injuriously obstruct navigation and make the lawful character of the structure depend upon his approval. Speaking by Mr. Justice Field, the court said (pp. 393-394):

> It is contended by the plaintiff with much earnestness that the approval of the Secretary of War of the plan and location of the bridge was not conclusive as to its character and effect upon the navigation of the river, and that it was still open to him to show that, if constructed as proposed, it would be an obstruction to such navigation as fully as though such approval had not been had. It is argued that Congress could not give any such effect to the action of the Secretary, it being judicial in its character. There is in this position a misapprehension of the purport of the act. By submitting the matter to the Secretary, Congress did not abdicate any of its authority to determine what should or should not be deemed an obstruction to the navigation of the river. It simply declared that, upon a certain fact being established, the bridge should be deemed a lawful structure, and employed the Secretary of War as an agent to ascertain that fact. Having power to regulate commerce with foreign nations and among the several States, and navigation being a branch of that commerce, it has the control of all navigable waters between the States, or connecting with the ocean, so as to preserve and protect their free navigation. Its power, therefore, to determine what shall not be deemed, so far as that commerce is concerned, an obstruction, is necessarily paramount and conclusive. It may in direct terms declare absolutely, or on conditions, that a bridge of a particular height shall not be deemed such an obstruction; and, in the latter case, make its declaration take effect when those conditions are complied with. The act in question, in requiring the approval of the Secretary before the construction of the bridge was permitted, was not essentially different from a great mass of legislation directing certain measures to be taken upon the happening of particular contingencies or the ascertainment of particular information. The execution of a vast number of measures authorized by Congress, and carried out under the direction of heads of departments, would be defeated if such were not the case. The efficiency of an act as a declaration of legislative will must, of course, come from Congress, but the ascertainment of the contingency upon which the act shall take effect may be left to such agencies as it may designate. (*South Carolina v. Georgia*, 93 U. S., 13.)

The only difference between that and the present case is this: In that case the right to *build* a bridge was made to depend upon the determination of the Secretary of War that it would not injuriously obstruct navigation. In the present case, the right to *maintain* a bridge already built is made so to depend. But this difference does not affect the character of the power devolved upon the Secretary. If administrative in the one case it must be so in the other. The fact that the act of March 3, 1899, refers to existing bridges lawfully erected, concerns only the power of Congress to require their alteration or removal. As we have seen, that power necessarily exists in Congress, the only question which can arise being whether the alteration or removal of a bridge shall be at the expense of the Government or of the bridge owner. So far as respects bridges constructed under the authority of the acts of December 17, 1872, and February 14, 1883, this latter question is settled by the express reservation therein of the right to alter, amend, or repeal the acts so as to prevent or remove all material obstructions to navigation without liability on the part of the Government. It is the ascertainment of this contingency merely that has been devolved upon the Secretary of War by the act of March 3, 1899. The efficiency of that act as a declaration of legislative will necessarily comes from Congress.

In *Lake Shore and Michigan Railway* v. *Ohio* (165 U. S., 365) the court, replying to the contention that Congress, by the corresponding act of September 19, 1890, had assumed entire control over all the navigable waters of the United States, including those situated wholly within a State, said (pp. 367-368):

> On the face of this statute it is obvious that it does not support the claim based upon it. Conceding, without deciding that the words "waterways of the United States," therein used, apply to all navigable waters, even though they be wholly situated within a State, and passing, also, without deciding, the contention that Congress can lawfully delegate to the Secretary of War all its power to authorize structures of every kind over all navigable waters, nothing in the statute gives rise even to the implication that it was intended to confer such power on the Secretary of War. The mere delegation to the Secretary of the right to determine whether a structure authorized by law has been so built as to impede commerce, and to direct, when reasonably necessary, its modification so as to remove such impediment, does not confer upon that officer power to give original authority to build bridges, nor does it presuppose that Congress conceived that it was lodging in the Secretary power to that end.

In *Field* v. *Clark* (143 U. S., 649) it was held not to be an unconstitutional transfer of legislative power for Congress to authorize the President to suspend, by proclamation, the free importation of certain articles, when satisfied that any country producing such articles imposed duties or other exactions upon the agricultural or other products of the United States which he might deem to be reciprocally unequal or unreasonable. The court said (p. 693):

> As the suspension was absolutely required when the President ascertained the existence of a particular fact, it can not be said that in ascertaining that fact and in issuing his proclamation, in obedience to the legislative will, he exercised the function of making laws. Legislative power was exercised when Congress declared that the suspension should take effect upon a named contingency. What the President was required to do was simply in execution of the act of Congress. It was not the making of law. He was the mere agent of the law-making department to ascertain and declare the event upon which its expressed will was to take effect.

These observations seem to apply with equal force to the situation presented by the act of March 3, 1899. The finding of the Secretary of War that a certain bridge is an unreasonable obstruction to navigation does not of itself make its further maintenance unlawful. That comes from the declaration of Congress that the navigation through or under such a bridge shall be reasonably free, easy, and unobstructed.

The Secretary simply ascertains and declares the event upon which the expressed will of Congress is to take effect.

In the recent case of *Buttfield* v. *Stranahan* (192 U. S., 470) the Supreme Court upheld the act of Congress forbidding the importation of tea inferior in purity, quality, and fitness for consumption to certain standards authorized to be fixed by the Secretary of the Treasury. In answer to the contention that the statute committed the determination of what tea might be imported to the arbitrary discretion of the Secretary, and therefore, in effect, vested him with legislative power, the court said (p. 496):

> We are of opinion that the statute, when properly construed, as said by the circuit court of appeals, but expresses the purpose to exclude the lowest grades of tea, whether demonstrably of inferior quality, or unfit for consumption, or presumably so because of their inferior quality. This, in effect, was the fixing of a primary standard, and devolved upon the Secretary of the Treasury the mere executive duty to effectuate the legislative policy declared in the statute. * * * We may say of the legislation in this case, as was said of the legislation considered in *Field* v. *Clark*, that it does not, in any real sense, invest administrative officials with the power of legislation. Congress legislated on the subject as far as was reasonably practicable, and from the necessities of the case was compelled to leave to executive officials the duty of bringing about the result pointed out by the statute.

The primary standard in effect fixed by the tea-inspection act, the court said, was "purity, quality, and fitness for consumption." That fixed by the act in question, so far as regards the obstruction of navigation by bridges, is "reasonableness." The one is no more definite and precise than the other; but in this case, as in that, it may be said that "Congress legislated on the subject as far as was reasonably practicable, and from the necessities of the case was compelled to leave to executive officials the duty of bringing about the result pointed out by the statute."

Section 11 of the act of March 3, 1899, provides that—

> where it is made manifest to the Secretary of War that the establishment of harbor lines is essential to the preservation and protection of harbors, he may, and is hereby, authorized to cause such lines to be established, beyond which no piers, wharves, bulkheads, or other works shall be extended or deposits made, except under such regulations as may be prescribed from time to time by him. (30 Stat., 1151.)

In an opinion rendered June 8, 1899 (22 Opin., 501, 511), Attorney-General Griggs held that, under the express authority given by this section, the Secretary of War was authorized to establish harbor lines whenever the interests of commerce require them, to restrict the encroachment of wharves, piers, etc., upon the waters of harbors, "and this notwithstanding the objection sometimes urged that this and kindred legislation are attempts to confer legislative or judicial power upon heads of departments or executive officers." "The power to determine the necessity for and location of harbor lines in a given harbor," said Mr. Griggs, "is obviously no more obnoxious to this criticism than is the power to determine whether the East River Bridge in New York will, if built according to a proposed plan, obstruct or impair the navigation of that river. And the conferring upon the Secretary of War the power to determine this is distinctly upheld in *Miller* v. *Mayor of New York*." (109 U. S., 385.)

After quoting the language of Mr. Justice Field in that case, and that of Mr. Justice Miller in *Wisconsin* v. *Duluth*, above cited, he said (p. 512):

> This delegation of the power is spoken of in these cases approvingly and as within the constitutional power of Congress, and any objection upon the ground of conferring

legislative or judicial power must now be too late, even if it would have had any force at any time.

In view of these authorities I have no hesitancy whatever in saying that the authority conferred upon the Secretary of War by section 18 of the act of March 3, 1899, is a lawful delegation of power.

It will be observed that the act in question does not authorize the Secretary of War to act arbitrarily. The party concerned is entitled to a hearing; to receive notice and a specification of the alterations required, and to have a reasonable time in which to make the prescribed changes. Not until all these steps have been taken does a willful failure to comply with the directions of the Secretary become a punishable offense.

There can be no doubt as to the power of Congress to attach this consequence to a failure to observe the requirements of the Secretary. Regulations prescribed by executive officials, under authority granted by Congress, it has been held, are regulations prescribed by law and have the force of law. The only question which can be made, where the authority granted was properly delegated, is as to the intention of Congress to make the violation of such regulations a criminal offense (*United States* v. *Eaton*, 144 U. S., 677). If, as here, the purpose to do so is clearly expressed, the power can not be doubted. (*In re Kollock*, 165 U. S., 526.)

It will be observed that the reservation by Congress in the acts of December 17, 1872, and February 14, 1883, is of the right to alter or amend those acts so as to prevent or remove all "material" obstructions to navigation by the future construction of bridges without any liability of the Government for damages on that account. In view of this qualification, a bridge constructed under the authority of either of those acts can not be deemed an "unreasonable" obstruction to navigation within the meaning of section 18 of the act of March 3, 1899, whose alteration may be required at the expense of the owner without compensation unless it is a material one. In fact it may be said that this is necessarily the meaning of the word "unreasonable" in the act in question. That act, as already stated, was undoubtedly intended to apply to bridges erected under authority of law. A bridge so erected certainly could not be declared an unreasonable obstruction to navigation unless it was a material one.

This disposes of all the questions upon which my opinion is directed by the act of June 13, 1902.

Respectfully,

W. H. MOODY.

THE SECRETARY OF WAR.

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## PRELIMINARY EXAMINATION OF CHANNELS IN OHIO RIVER AT OR NEAR ELIZABETHTOWN, ILLINOIS.

[Printed in House Doc. No. 79, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith a report, dated August 7, 1903, by Col. G. J. Lydecker, Corps of Engineers, on preliminary examination of Ohio River channels at or near Elizabethtown, Ill., made in compliance with a requirement of the river and harbor act of June 13, 1902.

The channel of the Ohio River at this point is divided by Hurricane Island, the through channel of the river being between this island and the Kentucky shore, and the proposed improvement contemplates the closing of this channel and opening a new channel between the island and the Illinois shore in front of Elizabethtown.

It is the opinion of Colonel Lydecker that the abandonment of the channel now in use and the improvement of that north of Hurricane Island is not desirable nor in the interest of general navigation or commerce; also, that the local commerce of Elizabethtown, present and prospective, is so limited that the creation and maintenance by the United States of a channel of approach to that point is not advisable.

This opinion is concurred in by the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act, and I concur in the conclusions of the Board as expressed in its report of August 19, 1903.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, August 7, 1903.*

GENERAL: In compliance with Department letter of June 23, 1902, I have the honor to submit the following report on a preliminary examination, called for by the river and harbor act of June 13, 1902, of "Ohio River, channels at or near Elizabethtown," Ill.

The Ohio River in this locality is divided by Hurricane Island, which is about 4.5 miles long with an extreme width of about three-fourths of a mile; the through channel is between this island and the Kentucky shore, while Elizabethtown lies on the Illinois shore of the channel on the other side, and opposite the lower end of the island, where ready access by water at low stages of the river is impracticable.

A complete survey of this section of the river was made in November and December, 1894, report of which was submitted by Col. Amos Stickney, Corps of Engineers, January 31, 1896, and published as House Document No. 238, Fifty-fourth Congress, first session, together with map showing in detail the then existing conditions of both channels. This report presented a project for closing the channel on the Kentucky side of the Hurricane Island and improving the back channel on the Illinois side, at an estimated cost of $95,000 in round numbers. In this report it is stated that the

> advantages of having the channel on the right (Illinois) side of the island are that Elizabethtown would become accessible to boats at all stages, the channel at stages when large coal tows run would be wider and straighter; the low-water channel

would be much better by eliminating two river crossings, one at the head and one at the foot of Hurricane Island. The existing crossing at the head is a very bad and sometimes dangerous one.

An earlier survey of the same locality was made by Maj. William E. Merrill, in 1880, and special attention is invited to his very full and instructive report thereon. It will be found in the published Annual Report of the Chief of Engineers for 1881, pages 1922–1926. He "roughly" estimates the cost of closing the channel on the Kentucky side, exclusive of any work in the channel on the Illinois side, at $150,000, and concludes his report as follows:

> Inasmuch as the proposed change would be of no benefit to general commerce, I would earnestly recommend that, should Congress see fit to order it, a special appropriation be made for the work, as the general appropriation for the Ohio River is never large enough to build the works that are urgently demanded for general commerce, and consequently many dikes whose construction would greatly benefit navigation are necessarily postponed from year to year.

After careful * * * personal examination of the locality last season and full consideration of a more detailed examination made later under my directions by Assistant Engineer J. N. Caldwell, I am of the opinion that the conclusions reached by Major Merrill in 1881 apply with equal and probably greater force to the conditions now existing. At that time, as also at the time of Colonel Stickney's later survey in 1894, the population of Elizabethtown was reported at about 800, but present statistics indicate a reduction to 668. It also appears that the channel on the Illinois side of Hurricane Island has been gradually filling up in recent years, the bar at the head being higher than in 1894 and that at the foot having extended nearly half a mile farther downstream. At the time of this examination (October, 1902) the river was at a stage of from 2.4 to 7.3 feet above low water, as shown by the nearest regular gauge, being that at Evansville, 94 miles above Elizabethtown, but the wharf boat for the local landing at the latter point was then located about 2,000 feet downstream from the position it occupied in 1894, and it is reported that its low-water location would now be nearly a mile below the berth it occupied in 1894.

It is safe to say that the cost of closing the present channel on the Kentucky side of Hurricane Island, and opening one approximately as good for general navigation on the Illinois side, would now be not less than $250,000; the cost that would attach to the maintenance of the latter channel after securing it is wholly a matter of guesswork. I am therefore of the opinion that the abandonment of the channel now in use, and improvement of that north of Hurricane Island as a substitute, is not desirable, nor is such course required in the interest of general navigation or commerce; also that the local commerce of Elizabethtown, present and prospective, is so limited that the creation and maintenance by the Government of a special channel of approach to that point is not advisable.

Very respectfully, your obedient servant,

G. J. LYDECKER,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 14, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brigadier-General Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., August 19, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of "Ohio River, channels at or near Elizabethtown," Ill., and other data available.

The Board agrees with the district officer in the opinion that the closing of the channel on the Kentucky side of Hurricane Island and the opening up of a channel on the Illinois side are not desirable in the interests of the general navigation of the Ohio River, and that the present and prospective commerce of Elizabethtown is not sufficient to justify the great expense of the works that would be required to effect these changes or even the less expensive works required to provide a special channel of approach to this town.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of Board.*

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## D D 6.

## PRELIMINARY EXAMINATION OF MOUND CITY HARBOR, OHIO RIVER, ILLINOIS.

[Printed in House Doc. 171, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 10, 1903.*

SIR: I have the honor to submit herewith, for transmission to Congress, report of October 27, 1903, by Col. G. J. Lydecker, Corps of Engineers, on preliminary examination authorized by the river and harbor act approved June 13, 1902, of—

> Harbor at Mound City, on the Illinois side of the Ohio River, with a view to ascertaining whether or not work at that point is necessary in the interest of navigation for the preservation and improvement of said harbor.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and attention is respectfully invited to the Board's report of December 2, 1903, in second indorsement thereon.

A plan for the improvement of the Ohio River at Mound City is now in force, and, for the reasons given, the Board agrees with Colonel Lydecker—

> that no work at this point is necessary in the interests of navigation for the preservation and improvement of said harbor other than that contemplated by the existing approved project, and that it is not desirable for the United States to undertake other work at this point.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS.

United States Engineer Office,
*Cincinnati, Ohio, October 27, 1903.*

General: Complying with instructions from the Office of the Chief of Engineers, I submit this report on an examination of Mound City Harbor, Ohio River, called for by the following extract from the river and harbor act of June 13, 1902:

> Sec. 14. That the Secretary of War is hereby directed to cause preliminary examinations or surveys to be made at the localities named in this section as hereinafter provided. * * *
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> * * * * * * *
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> Harbor at Mound City, on the Illinois side of the Ohio River, with a view to ascertaining whether or not work at that point is necessary in the interest of navigation for the preservation and improvement of said harbor.
>
> * * * * * * *

This locality is about 6.5 miles above the mouth of the Ohio River, and much work has been done there during the past ten years with a view to establishing and maintaining a reliable channel along the Mound City frontage. This work includes the construction in 1893–94 of dikes aggregating about 2,070 feet in length for the purpose of directing and concentrating the low-water flow of the river toward the Illinois side, and dredging, from 1894 to 1901, inclusive, to the extent of about 230,500 cubic yards within the limits of the channel that it is desired to open and maintain, the material thus far excavated having been generally of a character that could not be scoured out by the river current, and a large part of it had to be drilled and blasted before it could be removed by the dredges. Further improvements are authorized under projects approved April 3, 1899, and May 4, 1900, which contemplate additional dike construction and dredging and for which the sum of $75,000 has been duly allotted. The high stage of river that has prevailed in the locality during the past three years has prevented any progress in the work of dike construction called for under these projects, and for this reason operations under them have been limited to the dredging that was done during the years 1899 to 1901, inclusive, amounting to about 140,000 cubic yards.

These improvements form a part of the general project for improving the Ohio River by open-channel work, and the means for carrying them on have been supplied, as needed, by allotments from the regular appropriations for that improvement. The total of allotments thus far made for the Mound City locality is $110,000, of which $76,281.48 has been expended to date, leaving $33,718.52 now available for carrying on work under the approved project. It is assumed that further allotment will be made in like manner to the extent necessary for the proper completion of the improvement of the locality in question.

The locality was carefully examined during the fall of 1902, when the river in that section was at a stage of from 10.5 to 17.5 feet above low water, though the general stage was much lower in the upper sections, to which the effect of backwater from the Mississippi River did not extend. This examination showed that the dredged channel was then filled by deposits to a height of from 2.5 to 6 feet above the plane to which it had been dredged, but this showing was nothing more than should have been expected while the river was at such a high stage, because the deposits were of light material brought there while the river was in flood and before the more contracted flow of water that attaches to lower stages could show any appreciable effect; in fact, there have been but a few days during the past three years when the stage of water on the Ohio River in this locality has been less than 10 feet above low water, and at no time within this period has it been practicable to do any effective work on constructing dikes or dams whose tops are designed to be at an elevation of only 4 feet above a low-water stage.

For like reason it is impossible to state now, from observation, just what depth may be shown there when the river shall again recede to a normal low-water stage, but it is quite certain to be found much better than at many other points on the lower river where no contraction or other improvement has yet been made, and where work in the interests of through navigation at that stage is likely to be more needed than at this particular place.

In view of the foregoing, I am of the opinion that no other work is now necessary or advisable in the interests of navigation for the preservation and improvement of this locality, than such as is already contemplated by the existing approved project of improvement, the controlling features of which are indicated on the accompanying blueprint.[a]

Very respectfully, your obedient servant,

G. J. LYDECKER,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 3, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

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[a] Not printed.

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 2, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The within report of the district officer on a preliminary examination of "Harbor at Mound City, on the Illinois side of the Ohio River, with a view to ascertaining whether or not work at that point is necessary in the interest of navigation for the preservation and improvement of said harbor," and such other data upon this subject as are available, have been considered by the Board of Engineers for Rivers and Harbors.

Work near Mound City, Ill., for the improvement and preservation of that harbor and of the channel in front of the town is included in the general project for improving the Ohio River by open-channel work, and has been underway at various times during the past ten years. This work includes dike construction and dredging. Owing to continued high stages for several seasons the progress of the work has been slow, but it is advancing as conditions permit.

Allotments amounting to $110,000 have been made for this locality, of which over $33,000 is still available.

In view of the foregoing, the Board concurs with the district officer that no work at this point is necessary in the interests of navigation for the preservation and improvement of said harbor other than that contemplated by the existing approved project, and that it is not desirable for the United States to undertake other work at this point.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## D D 7.

## PRELIMINARY EXAMINATION OF OHIO RIVER FROM MOUND CITY TO CAIRO, ILL.

[Printed in House Doc. No. 308, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 24, 1903.*

SIR: I have the honor to submit herewith for transmission to Congress a report dated December 7, 1903, by Col. G. J. Lydecker, Corps of Engineers, on preliminary examination authorized by the river and harbor act approved June 13, 1902, of Ohio River from Mound City to Cairo, Ill., "with a view to ascertaining what improvement, if any, is desirable for the protection of the banks and levees on the Illinois side in the interest of navigation."

In accordance with the provisions of section 14 of the act, the report has been considered by the Board of Engineers for Rivers and Harbors provided for in section 3 of said act, and its report is contained in third indorsement thereon.

After giving the subject careful consideration Colonel Lydecker expresses the opinion, based upon the facts and reasons presented in his report, that the interests of navigation do not now require the protection of the banks or levees along the river as contemplated in the act, and this opinion is concurred in by the Board and by me.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, December 7, 1903.*

GENERAL: I have the honor to submit the following report on a preliminary examination of the "Ohio River from Mound City, Ill., to Cairo, Ill., with a view to ascertaining what improvement, if any, is desirable for the protection of the banks and levees on the Illinois side in the interest of navigation," as required by the river and harbor act of June 13, 1902, the duty of making this examination having been assigned to me by Department letter of June 23, 1902.

A report on this same question was made by Maj. W. H. Bixby, Corps of Engineers, October 3, 1899, to comply with the river and harbor act of March 3, 1899, which was published as House Document No. 137, Fifty-sixth Congress, first session. But a republication of a large part of it is believed to be most appropriate in connection with this paper, as the facts and considerations then presented apply with equal force at present. The following extract is therefore submitted:

Mound City, Pulaski County, Ill., is situated on the west side of the Ohio River, about 8 miles above its mouth and about 4 miles above Cairo, Ill. Mound City is a place having in 1890 a population of about 2,500 inhabitants and to-day perhaps double that number. It is a regular stopping place for all Ohio River packets descending the river. It has several manufactories along the river bank and a large marine railway for the construction and repair of river boats. It is a place of moderate commercial importance at present, but with a good prospect of large future development. Mound City itself is surrounded by a very good levee rising to above the highest water yet known at this place, and this levee extends down the river bank almost to Cache River. At Mound City the Illinois bank is building out rather than cutting away, and there is as yet no indication of the necessity of any special new protection to the levees.

Cairo, Alexander County, Ill., with its center about 6 miles below Mound City, lies at the mouth of the Ohio River and between it and the Mississippi River; the city proper being about 4 miles in length, with a breadth of about 1 to 1½ miles at its center and widest points, and with its center about 2 miles above the junction of the two rivers. Cairo had in 1890 a population of about 10,000 inhabitants and is at present perhaps twice as large. It is a regular stopping place for all Ohio River and Mississippi packets on their way downstream; is one of the most important towns in southern Illinois, especially as a distributing center for the adjoining portions of Illinois, Kentucky, and Missouri, and while of late years not growing as rapidly as some of the other towns of the State, has a good prospect of a much greater and much more rapid increase in commercial importance in the near future Three railroads enter the city directly, and two others are connected to it by ferry transfers.

A considerable part of the city proper and almost all of its harbor front, both on the Ohio and the Mississippi, and much land outside are under the control of the so-called Cairo Trust, a private corporation which succeeded the Cairo City and Canal Company sometime in the neighborhood of 1850. The city is entirely surrounded by a fine levee rising to the 55-foot level (about 2 feet higher than the highest floods known up to the present time), so that the city itself is amply protected against all danger from damage by overflows or by cutting of the banks from either the Ohio River or the Mississippi River. There is at present no indication of undue scour along the city front on its Ohio River side, so that nothing is specially needed at this point in the way of protection for its banks or levees.

The Illinois bank from the lower end of Mound City to the upper end of Cairo, about 4 miles in length, is the portion of the bank evidently referred to in the act of March 3, 1899, as that to be examined with a view to protection or improvement. The upper mile of this stretch of river bank covers a distance from Mound City down to Cache River, Cache River being a large slough which drains an area of perhaps 400 or 500 square miles, lying just above Cairo in the angle between the Ohio and Mississippi rivers. The Cache River Basin reaches so near the eastern bank of the Mississippi River a few miles above Cairo that in recent years it has been thought desirable to strengthen the Mississippi River embankment a few miles above Cairo to prevent the Mississippi River from possibly cutting through this embankment into the Cache River Basin and thence into the Ohio River in such way as to form a cut-off in the Mississippi River above and around Cairo, but such protection work concerns the Mississippi River and not the Ohio, and such work, if done, must be done on the Mississippi side. There is at present no indication of any danger that the Ohio River will enter the Cache River Basin and cut through the Mississippi River banks into the Mississippi River. No protection or strengthening of the Ohio banks from Mound City down to the mouth of Cache River would be of any special value in keeping the Ohio River out of the Cache River Basin, and a total closure of the Cache River mouth would be impracticable.

From the mouth of the Cache River down to the upper end of the city of Cairo, a distance of about 3 miles, the river bank is concave in shape, is washed directly by the Ohio River channel currents, and is gradually wearing away in such manner as to deepen the concavity. Maps, old and new, of this part of the river show that the general shape of the river bank between Mound City and Cairo is not now much different from what it was in 1810, but that the river bank has, however, worn back steadily ever since that date.

Prior to 1880 the cutting of the bank along this 3 miles of river was very slight, amounting from 1810 to 1880—that is, during seventy years—as shown by the Coast Survey maps of 1880, to a total recession of only about 140 feet in all, or an average of only about 2 feet per year. During this interval there were apparently no levees on the Illinois bank between Mound City and Cairo, and during high freshets the river, as soon as it rose above a 30-foot stage, could overflow its banks along this whole 3-mile length and expand readily into the whole of what is now known as the "Cairo Trust drainage district," and also into the whole Cache River Basin. This freedom of expansion must necessarily have reduced very greatly the flow of water in the main river and slackened its current, and may have accounted very greatly for the slow cutting of the bank. Sometime after 1880, however, the Cairo and Vincennes Railroad converted its railroad track, then distant only about 600 feet at the most from the river bank, into a high embankment rising to above the highest freshets; and about the same time the Cairo Trust built a levee of its own along the north side of its property on the Cache River front, thus shutting off this natural overflow of the Ohio River at high stages and preventing its entrance into the Cache River Basin except through the narrow mouth of the Cache.

From 1873 to 1889 the cutting of the banks was much greater than before, commencing just below Mound City and above the mouth of the Cache, extending down almost to the upper end of Cairo, and amounting, in some places, to a recession of about 300 feet, or an average of 20 feet per year. The construction of this railroad embankment so near the river bank is undoubtedly responsible for some of the increased erosion of this stretch of bank. It is possible that this increased erosion may have been anticipated or feared by the Cairo Trust owners, as in giving to the railroad companies a right of way through their property the trust company bound the railroad companies to maintain permanent levees along such rights of way next the river bank, by which they provided for the permanent protection of their trust properties. Any parties building such levees alongside of a large river like the Ohio should expect and prepare for a possible increased erosion of the banks, and should, for the protection of their own properties, arrange for a riprap or other protection of such banks in case the increased erosion actually occurs.

The cost of such protection, however, is clearly something in which the public at large is not specially interested, and for which it should not be expected to pay. From 1889 to 1897 the maximum recession was about 130 feet, or about 16 feet per year; but since then the cutting has increased much more rapidly, the rate between 1897 and 1899, in the worst places, amounting to a total of 100 feet, or an average of 50 feet per year. Even this cutting, however, can go on for ten to twenty more years before in any way seriously interfering with the Ohio River navigation or with the commercial interests of Mound City or Cairo, but of course not without serious injury to the private riparian properties on which the cutting occurs.

In about 1893, at the request of those interested in the navigation of this part of the Ohio River, the Government commenced the improvement of the bar opposite Mound City for low-water use by steamboats and barges, doing this by dredging in the deepest part of the river near the Illinois side, and by building a low dike halfway across the river from the Kentucky side. As the dike was very low, rising to not more than 4 feet above low water, and as the dredged channel was narrow and has not as yet, even with the aid of the dike, increased the channel depth more than 3 feet, and as the serious cutting and caving of the river bank below the dike is only produced during river stages of from 30 to 50 feet depths, the low diking and shallow dredging so far done by the Government become insignificant at bank-cutting stages, and so can hardly be held responsible for the recent rapid cutting below Mound City since 1893, and certainly not for the great increase in cuttfng previously evident between 1873 and 1889.

A more probable reason for the more rapid caving of this bank within recent years is that the portions of the bank now exposed to river action show evidence of a stratum of fine sand, in some cases 3 feet in thickness, underlying the natural surface of the drainage district property at a distance of about 18 feet below the surface of that property, and so at a distance of only about 12 feet above low-water level. When the river rises to stages of 30 feet and upward, the exposed face of this sand stratum easily washes out into the river, and the bank above it then naturally falls of its own weight and slides off into the river, where it is easily washed away by the natural current of the river.

Although this recession of banks is quite extensive, it is hardly any more so than at many other places along the Ohio River above Mound City. The Ohio River has already hundreds of miles of caving banks, whose proper protection would probably cost over $20,000,000. Such protection, however, seems at present secondary to the removal of the existing river bars, the latter work needing all the funds that can be spared by the United States for several years to come. Until the United States is prepared to assume the protection and repair of all the caving banks along the entire length of the Ohio River, and their ownership, it would seem to me that all such work should be done by and at the expense of the private parties who are directly interested, and who benefit by the riparian rights, and should not be done at the expense of the General Government.

The land between the river and the Cairo and Vincennes Railroad, as well as that in rear of this railroad along the 3-mile length of river bank from Cache River to Cairo, is almost all under the ownership or control of the Cairo Trust. Some of the recent descriptions circulated by this trust claim in this area an ownership of 7,000 acres of excellent land, some of which is reported to have produced over $1,000 worth of crops (per acre) in one year. This tract of land lies at a general elevation of about 30 feet above low water, so that without protectlon of some sort it would always be covered by winter freshets. The mass of this property is, however, protected on its south side by the Cairo city levee; on its east side from the Ohio River floods by the levee of the Cairo and Vincennes Railroad; on the west side from the Mississippi River floods by the levee of the Mobile and Ohio Railroad; and on its north side next the Cache River by the Cairo Trust's own levee; while east of its center, and at least one-half mile back from the Ohio River bank, this protection is reenforced by the levee of the Illinois Central Railroad.

This tract of land, with a 3-mile frontage on the Ohio River and a slightly greater frontage on the Mississippi River, and lying between Cairo city proper and the Cache River Basin, goes by the name of the "drainage district," belongs almost all to the Cairo Trust, and is given up almost entirely to agricultural purposes, there being no city or town properly so called within its limits. The railroad levees through this property rise to a level of about 55 feet, so that they thoroughly protect the district from overflow. Should the wear of the banks continue at its present rate for two or three years more, the Cairo Trust, for the protection of its 7,000 acres of drainage district lands, or the Cairo and Vincennes Railroad, for the protection of its own line of track, as well as for the protection of the Cairo Trust drainage district in its rear under the terms of its rights of way, or both, will be obliged to protect their river fronts against further erosion, or else will have to move back as the river advances.

* * * * * * *

> My various examinations show, therefore, that between Mound City and Cairo, along the stretch of river referred to in the act above named, there is no special caving of the banks at all unusual for the Ohio River, and none greater than at many other places in the river above; that such caving is not extensive enough to seriously affect at present the navigation of the Ohio River, nor would it do so if the caving should continue without interruption for many years to come; that the protection of this bank is not essential either to Mound City or to Cairo and can have no decided effect on the commerce of either place, and that the only large special interests involved at the present time or for the next few years are those of the private properties of the Cairo and Vincennes Railroad and the Cairo Trust Company, and not that of the general public.
>
> I have therefore to report that in my opinion the improvement of the Ohio River bank from Mound City to Cairo is not at present necessary to the interests of navigation, and is not at present worthy of being undertaken by the General Government.

The examination called for by the river and harbor act of June 13, 1902, was made with great care in November and December, 1902, by Asst. Engineer J. N. Caldwell, who was during that period in charge of a field party engaged in miscellaneous surveys on the lower portions of the river. The result of it was to show that the general conditions remain essentially as described in the foregoing extract from Major Bixby's report of his examination in 1899. The bank erosion referred to in that report has continued along the bend on the Illinois side, between Mound City and Cairo, but the top of the bank was still found to be from 90 to 275 feet in advance of the levee or embankment on which the tracks of the Cairo and Vincennes branch of the Big Four Railroad are laid, and the outer slope of this levee is well protected by riprap. At two points where indications of undermining had become most apparent, the railroad company took measures, in 1900, to counteract such action by excavating trenches outside of the levee slope, through the permeable material, and refilling the trenches with clay. Except for the possibility of undermining at some other parts of this levee, the entire system of levees was found to be solid and substantial.

It has been suggested that the Illinois bank should be revetted or protected between Mound City and Cairo, because there is danger that the Ohio River, when in high flood, may cut through to the Mississippi, back of Cairo, to the probable injury of navigation; the distance between the two rivers at the narrowest part of the peninsula by which they are separated being only about three-fourths of a mile. This could only occur as a result of simultaneous breaches through the several substantial levees or railroad embankments that now cross the suggested line of cut-off, viz, the Big Four levee on the Ohio River bank, and the three embankments of the Illinois Central and Mobile and Ohio railroads. It is believed that such an occurrence is in the highest degree improbable, if not actually impossible; in any event the existence or nonexistence of the suggested bank protection would not be likely to have any material effect on the result in such a crisis.

It has also been contended that bank protection is needed below the mouth of the Cache River, in the interest of navigation, as continued erosion tends to make the bend in that part of the Ohio a sharper one and more difficult to navigate. The length of bank to be protected would be nearly 14,000 feet, and it is estimated that the cost of an efficient and durable method of protection would be from $10 to $12 per linear foot, or about $150,000 for the distance in question. The cost would be wholly incommensurate with the resultant benefits to navigation.

A map[a] is submitted herewith which shows the location of the levees and other embankments, together with a profile across the peninsula between the Ohio and Mississippi rivers. It also indicates the central line of low-water channel in the Ohio River below Mound City, showing that the bend above referred to is quite a gentle one with a radius of about 8,400 feet.

After careful consideration of all the data supplied by Assistant Engineer Caldwell's survey and investigations, and a close personal examination of the bank and channel of the river, and of the several levees and embankments, I am of the opinion that the interests of navigation do not now require protection of the banks or levees on the Illinois side of the Ohio River between Mound City and Cairo, Ill.

Very respectfully, your obedient servant,

G. J. LYDECKER,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 11, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

W. V. JUDSON,
*Captain, Corps of Engineers.*

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 15, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The within report on a preliminary examination of "Ohio River from Mound City, Illinois, to Cairo, Illinois," has been carefully reviewed by the Board of Engineers for Rivers and Harbors.

The river and harbor act of March 3, 1899, called for a report on this same subject. This report is published in House Document 137, Fifty-sixth Congress, first session. The district officer states that the facts and considerations then presented apply with equal force at present and quotes from said report at length.

It is clearly shown within that the protection of the banks and levees between Mound City and Cairo is not necessary in the interests of navigation; that water-borne commerce would in no way be affected thereby, and that the only benefits to be expected from such improvement would inure to the Cleveland, Cincinnati, Chicago and St. Louis Railway Company and riparian owners.

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[a] Not printed.

In view of these facts the Board expresses the opinion that no improvement for the protection of the banks and levees on the Illinois side of the Ohio River, between Mound City, Ill., and Cairo, Ill., is desirable in the interests of navigation. The Board therefore believes that the United States should not undertake this improvement, and so recommends.

For the Board.

A. M. MILLER,
*Lieut. Col., Corps of Engineers,*
*Senior Member Present.*

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## D D 8.

### PRELIMINARY EXAMINATION OF OHIO RIVER, WITH A VIEW TO THE CONSTRUCTION OF A MOVABLE DAM BELOW MOUTH OF GREEN RIVER, KENTUCKY.

[Printed in House Doc. No. 643, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, March 24, 1904.*

SIR: I have the honor to submit herewith, for transmission to Congress, a report dated December 10, 1903, by Col. G. J. Lydecker, Corps of Engineers, on the preliminary examination authorized by the river and harbor act approved June 13, 1902, of "Ohio River, below the mouth of Green River, with a view to the construction of a movable dam, so as to make a harbor at Henderson, Ky., and Evansville, Ind., and to give a depth of 6 feet on the lower miter sill on Lock No. 1, Green River."

As a result of his investigation Colonel Lydecker finds that a point on the Ohio River about 7 miles below Henderson and 35 miles below the Green River lock would probably be the best location for a dam to accomplish the double object in view. From an engineering standpoint the site is not favorable, the bed of the river being composed of sand and gravel to an unknown depth. The channel depth in the Ohio River throughout most of the distance under consideration is more than 6 feet even at the lowest stage, and in the immediate vicinity of Henderson and Evansville it ranges from 4 to 20 feet. Colonel Lydecker states that this condition of affairs permits the local use of screw propellers, even during low-water periods, an exceptional advantage that can be found at but few other localities outside of the pooled portions of the river. It therefore appears that a general increase in depth through the Evansville-Henderson section is not a matter of great moment at present, either for general or local navigation. He believes that the construction of a movable dam is not necessary to make a harbor at Henderson, Ky., and Evansville, Ind.

The advisability of constructing a dam as a means of giving a depth of 6 feet on the lower miter sill of Lock No. 1, Green River, remains to be considered. From previous reports, and from Colonel Lydecker's report, it appears that low water in the Ohio provides a depth of 2 feet over the lower sill of the lowest lock on the Green River series, and that the stages of the Ohio are such that during the years from 1889 to 1897, both inclusive, the average number of days per year on which the depth over the lower miter sill was 6 feet or more was 305, or, in other words, the depth which it is sought to produce by the construction of a movable dam in the Ohio is already provided by nature for an average period of ten months per year.

In view of all the facts stated Colonel Lydecker concludes that the interests of navigation at present do not require the construction of a lock and dam below the mouth of the Green River for the purposes considered in the report, and that it is not advisable to undertake the work at this time.

Colonel Lydecker's report was referred, as required by law, to the Board of Engineers for Rivers and Harbors created by section 3 of the river and harbor act approved June 13, 1902. A committee of the Board visited the locality and held on January 22, 1904, a public hearing at Evansville, Ind., at which interested parties submitted arguments and statements in favor of the proposed improvement. In its accompanying report, dated February 23, 1904, to which attention is respectfully invited, the Board states that the benefits to be expected from the construction of the dam may be itemized as follows: (*a*) To the commerce of Green River; (*b*) to the harbors of Henderson, Ky., and Evansville, Ind.; (*c*) to the general commerce of the Ohio River.

With regard to the first, the Board states that Evansville is properly the terminus of the Green River navigation, and that the construction of the dam in question would tend to cheapen transportation on the Green River, and probably give rise to increased traffic.

In regard to the second, viz, the harbors at Henderson and Evansville, the Board finds that the depths now existing are ample for the passage of craft that may reach them from above and below, and greater than in many other reaches in the Ohio River. Nevertheless, if the water fronts of these towns were thrown into a pool the facility with which coal and other freight might be handled would increase.

With regard to the general commerce of the Ohio River, the Board finds that about 40 miles of the river would be pooled by a dam below Henderson and certain shoals would be drowned out, but it does not appear that the stretch that would be bettered is the worst of those between Louisville and Cairo which might be improved by similar means; that the necessity of lowering such a dam when ice in the Ohio River is running or forming rapidly would limit materially the advantages to be expected from it in rendering the lower part of the Green

River available as an ice harbor for Ohio River shipping; that it is probable that a pool here would be of some service, and through navigation be afforded a harbor for tows caught by a falling river, though the existing natural pools largely answer the same purpose.

From correspondence with certain prominent interests in the coal trade, the Board draws the conclusion that they advocate the improvement on account of its local advantages and as a step toward the complete canalization from Louisville to Cairo, but do not consider it of much value to the through coal traffic from Pittsburg when standing alone.

After discussing the commercial conditions and the advantages expected from the proposed work, the Board concludes that it is not now advisable to undertake the construction of a movable dam in the Ohio River for the purposes named in the act.

The law ordering this preliminary examination requires a report upon it simply from the point of view of the benefit to the harbors at Henderson and Evansville and to the Green River navigation. The facts brought out by the preliminary examination sufficiently indicate the inadvisability of the construction from these points of view. The project has, however, been pressed on the additional ground that a dam so established would be one of a chain of canalization in the lower Ohio, extending from Louisville to the mouth of the river, and to make this report complete this phase of the matter must be touched upon. By appropriating money for Dam No. 37, just below Cincinnati, on the Ohio River, Congress has indicated its intention of adopting, at least in part, the project printed in House Document No. 336, Fifty-seventh Congress, first session, founded upon a survey of the Ohio River from Marietta to the mouth of the Big Miami, 503 miles below Pittsburg, which project provides for canalization between these points, and is an extension of a previously adopted project to provide slack-water navigation from Pittsburg to Marietta.

Although work on the first dam of this series, namely, the one at Davis Island, was begun twenty-five years ago, only two of the dams have yet been completed, seven more are under construction, and money has been appropriated for five additional ones. As yet, therefore, only a beginning has been made on the project for 38 dams, carrying slack water to the mouth of the Big Miami. No provision has been made for the portion lying between this river and the head of the Falls at Louisville, and it seems premature to locate at this time a dam below the Falls, which would to a certain extent commit the Government to an extension of the slack-water project beyond any point yet considered, and before the portion already authorized has been so far finished as to enable its full usefulness to be correctly and certainly measured. The work which Congress may be assumed to have entered upon, namely, the slack-water system to include Dam No. 38, will have cost when completed, according to present estimates, about $38,000,000. The further extension to Louisville and thence to the mouth of the river would require probably about 18 more dams. The lower dams would necessarily be much larger than any on the upper river, would usually require a much more expensive foundation, and would cost very much more. Without attempting an accurate estimate for these structures it may be said that the total cost of the extension from the

Big Miami to Cairo may prove to be little, if any, less than the cost of the first 38 dams of the series from Pittsburg down.

I concur in the views of Colonel Lydecker, and of the Board of Engineers for Rivers and Harbers, that it is inadvisable at the present time to undertake the construction of a movable dam in the Ohio River below the mouth of the Green River.

Very respectfully, your obedient servant,

A. MACKENZIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. WM. H. TAFT,
*Secretary of War.*

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## REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, December 10, 1903.*

GENERAL: I have the honor to submit the following report on a preliminary examination of "Ohio River, below mouth of Green River, with a view to the construction of a movable dam, so as to make a harbor at Henderson, Ky., and Evansville, Ind., and to give a depth of six feet on the lower miter sill on Lock Numbered One, Green River," such examination having been called for by the river and harbor act approved June 13, 1902, and the duty of making it assigned to me by Department letter of June 23, 1902.

The detailed examination was made in October and November, 1902, under the direction of Mr. R. R. Jones, chief assistant engineer in this district, and attention is invited to his report submitted herewith.

The examination called for by Congress may most appropriately be considered under two distinct headings: First, the advisability of constructing a dam that will provide additional harbor facilities in the Ohio River at Henderson, Ky., and Evansville, Ind.; and, second, the advisability of making any dam in the Ohio River for the purpose of providing a depth of 6 feet over the lower sill of Lock No. 1, Green River. These two considerations made a somewhat detailed survey of the Ohio River necessary for a few miles below Henderson, with a view to finding a suitable dam location as respects the suggested harbor facilities, and a determination of the low-water surface from the site of such dam to Lock No. 1, Green River. For these purposes a small surveying party was placed in the field in charge of Junior Engineer F. A. Bone, by which the river hydrography below Henderson was ascertained for a distance of about 7 miles, and a suitable site for a dam thereby developed, and a line of levels run between there and Lock No. 1, Green River, to determine the low-water surface in the interval and fix the height that would be needed for the dam below Henderson to provide a pool whose low-water surface would be 6 feet above the lower sill of the Green River lock.

The result of this work was to show that a dam in the Ohio River at a point about 7 miles below Henderson and 35 miles below the Green River lock would probably be the best location for the double object in view. At this location the crest of the dam would have to be placed at an elevation of 12 feet above low water in the Ohio and 20 feet above the bed of the river. From an engineering standpoint the location is not a favorable one for lock and dam construction, the bed of the river being composed of sand and gravel to an unknown depth and the banks of similar material combined with some loam and clay. No indication of rock is found in the locality or near it. * * *

An index chart[a] of the rivers within the limits under consideration, and profile[a] along the low-water channel, accompany this report, from which it appears that the channel depth throughout most of the distance is over 6 feet, even when the Ohio is at its lowest stage, and in the immediate vicinity of Henderson and Evansville it ranges from 4 to 20 feet. This condition of affairs permits the local use of screw propellers even during low-water periods, an exceptional advantage that can be found at but few other localities outside of the pooled portions of the river. Any river craft that can reach this stretch of river from above or below can pass through it without trouble, so far as depth of water is concerned. It therefore appears that a general increase in depth through the Evansville-Henderson section is not a matter of great moment at present, either for general or local navigation on the Ohio. The principal advantage to navigation that would result from the construction of a dam at the suggested site, which is at the foot of the shoals below Henderson, would be a good channel over these shoals and the elimination of some shoal spots in the river above Evansville. It is confidently believed, however, that dredging and other open-river work would provide such improvement at these places as the interest of navigation requires for much less cost than lock and dam construction would require, and without imposing on navigation the annoyance or delay of passing through a lock.

The advisability of constructing this dam as a means of giving a depth of 6 feet on the lower miter sill of Lock No. 1, Green River, remains to be considered, and in this connection attention is invited to report submitted by Maj. Jas. F. Gregory, Corps of Engineers, U. S. Army, dated April 3, 1897, on a survey of Green River for a new lock and dam at or near its mouth. It was published as House Document No. 30, Fifty-fifth Congress, first session, and also in the Report of the Chief of Engineers for 1897, pages 2504–2511. This report contains a project for locating a new lock at the west end of Dam No. 1, on the opposite side of the river from the present lock, and estimates the cost of constructing it at $230,000, in round numbers, including the cost of excavation needed in the river below the lock to give the same depth of water in its channel as over the lower sill of the new lock. As respects the advisability of constructing the new lock, Major Gregory reports as follows:

> * * * In examining the present commerce of the river it appears that at no time, except perhaps during a short period of high water in the logging season, is the lock ever worked to its full capacity, so that even if the present commerce were to be increased many times the present size would accommodate all demands upon it.
>
> With regard to the depth of water on the lower miter sill [of present Lock No. 1], reference is invited to tables showing the depths of water on the sill during each

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[a] Not printed.

year from 1889 to 1897 contained in the accompanying report of Mr. G. F. Stickney, assistant engineer, dated February 10, 1897. From these tables it appears that during seven [consecutive] months of the year there is sufficient water in the Ohio to enable coal to be brought out of Green River. Of this condition no advantage whatever has been or is being taken.

The coal developments on Green River thus far are sufficient for a good local supply, and that is about all. Mining coal for shipment out of Green River by way of the Ohio River is wholly prospective, and the immediate future does not at present promise much in that direction; otherwise efforts would be made to utilize the present very fair navigation facilities afforded by the existing river improvements.

* * * * * * *

For the above reasons I can not but come to the conclusion that the proposed improvement is not at present justified by the interests of the commerce involved.

The commerce reported as passing Lock No. 1, Green River, during the fiscal year ending June 30, 1902, aggregates 385,548 freight tons, of which the principal items were: Timber, 254,759 tons; lumber and railroad ties, 92,480 tons; and only 334 tons of coal. For the year ending June 30, 1903, the total was 457,386 tons, of which the timber, lumber, and tie items amounted to 336,364 tons, and coal 74,765 tons. This shows a remarkable increase in the coal tonnage over that of the year 1902, or that reported for any previous year, viz, 1,365 tons in 1901; 139 tons in 1900; 1,786 tons in 1899; 236 tons in 1898, etc. It is suggested that this increase may have been due to an exceptional demand for Green River coal at local Ohio River points, because of the lack of supply and high prices incident to the strikes in other coal districts during the summer and fall of 1902.

For all practical purposes low water in the Ohio may be considered as providing a depth of 2 feet over the lower sill of Lock No. 1, Green River, and as corresponding to the zero of the river gauge at Evansville; and a 4-foot reading on the Evansville gauge as indicating under existing conditions a depth of 6 feet over the sill of Lock No. 1. In Major Gregory's report already referred to a statement compiled from the gauge records of Lock No. 1 is included for the years, 1889 to 1897, both inclusive, which shows that the average number of days per year on which the depth over its lower sill was 6 feet or more was three hundred and five. A similar statement compiled from the Evansville gauge records for the same period showed an average of three hundred and seven days per year when the stage was 4 feet or more. In other words, the water surface at both places was 4 feet or more above the plane of low water for an average of ten months in each year.

In view of all the facts I am unable to see that the interests of navigation require at present the construction of a lock and dam below the mouth of the Green River for the purposes considered in this report. It should be observed also that the limited scope of this examination affords no adequate means of determining whether the location of a dam that might best serve these special purposes would harmonize with the requirements of a fully developed project of improvement covering the 365 miles of open river between the canal lock at Louisville and Cairo. A detailed survey through this distance is a necessary preliminary to the preparation of such a project. In the meantime there are many obstructed sections of the river within these limits where improvement would be of more benefit to general navigation at present than a lock and dam below Henderson.

In view of the foregoing I am of the opinion that it is not advisable to undertake at this time the construction of a movable dam in the Ohio River for the purpose of making a harbor at Henderson, Ky., and Evansville, Ind., and giving a depth of 6 feet over the lower sill of Lock No. 1, Green River.

Very respectfully, your obedient servant,

G. J. LYDECKER,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 21, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation at an early date.

Additional data have been requested, if available.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., February 23, 1904.*

Respectfully returned to the Chief of Engineers, United States Army, inviting attention to report of this date.

For the Board:

A. M. MILLER,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## REPORT OF MR. R. R. JONES, CHIEF ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, December 9, 1903.*

COLONEL: I have the honor to submit the following report upon a preliminary examination made under my supervision, by your direction, of the "Ohio River, below the mouth of Green River, with a view to the construction of a movable dam, so as to make a harbor at Henderson, Ky., and Evansville, Ind., and to give a depth of 6 feet on the lower miter sill on Lock No. 1, Green River."

In order to utilize as far as possible the existing information on the subject, in the way of detached maps, etc., a small party was sent out during the season of 1902 in charge of a junior engineer (Mr. Bone) to run a line of connecting levels from Lock No. 1, Green River, to a point on the Ohio River below Henderson, Ky., and to connect same with former references at Evansville, Ind. A detailed survey was also made from Henderson, Ky., to a point 7 miles below the city, which covered the rather difficult piece of navigation opposite to and immediately below Henderson Island.

The result of this preliminary examination and partial survey is exhibited on maps and drawings herewith, as follows:

(*a*) A general map extending from Lock No. 1, Green River, to a point on the Ohio River about 7 miles below Henderson, Ky., and covering a little more than 35 miles of the two rivers. (Scale, 1 inch = 1,600 feet).

(*b*) A profile covering the same extent of river. (Scale, horizontal, 1 inch = 5,000 feet; scale, vertical, 1 inch = 4 feet.)

*Suggested site.*—It will be seen from the drawings that a suitable place for a dam which would give 6 feet of water on the lower miter sill of Lock No. 1, Green River, and at the same time make a harbor at Henderson, Ky., and Evansville, Ind., can be found at a point a little more than 7 miles below Henderson, Ky. Immediately below the suggested site of the dam a pool of deep water begins. This pool extends to the head of Diamond Island, a distance of about 6 miles. Extreme low water at the point suggested for the dam is about 6 feet below the lower sill level of Lock No. 1, Green River, so that a dam sufficiently high to give 6 feet over the sill of Lock No. 1, Green River, would require to have its crest about 12 feet above low water in the Ohio River at this suggested site, viz, about 3½ miles below the foot of Henderson Island, 7 miles below the city of Henderson, Ky., and about 35 miles by river below Lock No. 1, Green River.

*General characteristics of river.*—The low-water width of the Ohio at the site suggested for dam, is 1,410 feet, but the sand bars which border the channel are rather flat, and the width of river increases rapidly as the stage of water rises above the extreme low-water plane. At a stage of river 2 feet above low water the width of river is about 1,800 feet; at 4 feet above low water the width is about 1,990 feet; and at 6 feet above low water the width is about 2,150 feet.

*Bed and banks.*—The bed of the river, so far as can be determined is composed of sand and fine gavel; and the banks are formed of sand, loam, and clay. There are no indications of rock in the bed or banks of the river anywhere near the suggested site. During the construction of the Louisville and Nashville bridge, which crosses the Ohio River at Henderson, Ky. (7 miles above), shale rock was found, as shown by drawings on file in this office, at from 10 to 19 feet below low water. Near the town of Franklin, Ind., 13 miles below Henderson, there are outcroppings of rock, but none, so far as can be learned, between Henderson and Franklin.

*Height of dam, etc.*—The height of dam suggested is about the same (above the low-water plane) as that adopted for various movable dams on the upper Ohio, now in process of construction. If the sill of the navigable pass were to be built at a level 4 feet below low water, the sill would still be from 0.20 foot to 3.70 feet above the bed of the river, and the vertical height from top of sill to pool level would be 16 feet. It is not considered desirable to disturb the regimen of the river by obstructing its bed with sills rising to any greater height above the natural bottom than the height suggested. The height of dam above sill (navigable pass) being 16 feet, would necessitate a length of shutter somewhat greater than is now in use on the Ohio River, but, as believed, not beyond the limits of practical working in the manipulation of the dam.

*Length of dam.*—The total length of dam required would be about 2,010 feet from river face of land lockwall to river face of abutment on the opposite side of the river. This distance might be filled as follows:

| | Linear feet. |
|---|---|
| Lock, including river wall | 124 |
| Navigable pass | 800 |
| Bear traps, weirs, etc., up to abutment | 1,086 |
| Total | 2,010 |

The abutment on the Indiana shore would require considerable filling and should be reenforced by stone revetments extending up and down stream. It is probable that the natural bank on the Kentucky shore may also need special protection because of the soft material of which it is composed.

*Advantages of suggested site.*—The site suggested would create a pool which would flood the bars now obstructing the river bed from the head of Henderson Island to the dam. This pool would fulfill the requirements of 6 feet depth of water on the lower miter sill of Lock No. 1, Green River, and would raise the surface of the river opposite Evansville, Ind., about 5.25 feet. In other words, the dam would make a pool about 35 miles in length with a minimum depth of 6 feet over lower miter sill of Lock No. 1, Green River, and it would be as favorably situated as regards access to lock from below as at any other point suitable for the site of a dam.

* * * * * * *

*Desirability of the improvement.*—One clause in the river and harbor act which makes provision for the preliminary examination reads: "So as to make a harbor at Henderson, Kentucky, and Evansville, Indiana."

At present the harbor at Evansville, Ind., and the channel of the Ohio between that place and Henderson, Ky., has, at low-water stages, a much greater depth than is found at most localities. Propellers are used to a considerable extent in Evansville Harbor during low-water stages, and between Evansville and Lock No. 1, Green River. This is, in itself, an evidence that a fairly good depth of water exists in and about the harbor at low-water stages, for propellers are notoriously of greater draft than boats of similar power, but having stern wheels. It would appear, therefore, that the particular stretch of the Ohio River between the mouth of Green River and Henderson, Ky., is in less need of improvement than many other points which might be named.

The construction of a dam at the site suggested is undoubtedly quite feasible from an engineering standpoint, but the probable value of the improvement does not appear to be commensurate with the cost of the work.

A sum equivalent to the cost of the dam, judiciously expended on open-channel improvement, by the construction of dikes and dams, and by dredging, would, it is believed, result in far greater benefit to general navigation. Even if the probable cost of the dam has been over-estimated this principle would still hold good.

Considering all conditions, and existing requirements of navigation, it seems to me that the suggested construction of a dam below Henderson, Ky., to fulfill the conditions named in the river and harbor act of June 13, 1902, is not a pressing need, nor would it offer advantages from an economic standpoint at all comparable with open-channel improvement.

A statement of commerce passing Lock No. 1, Green River, and a comparison of gauge records of Evansville, Ind., and Lock No. 1, Green River, are hereto appended.

*Statement of commerce passing Lock No. 1, Green River, fiscal year ending June 30, 1902.*[a]

| | Tons. |
|---|---|
| Coal | 334 |
| Corn | 3,182 |
| Wheat | 624 |
| Salt | 963 |
| Oil | 187 |
| Whisky | 29 |
| Flour | 848 |
| Sugar | 520 |
| Molasses | 179 |
| Cement | 120 |
| Tobacco | 700 |
| Hides | 1 |
| Hay and straw | 333 |
| Cattle | 948 |
| Swine and sheep | 676 |
| Horses and mules | 73 |
| Lumber | 16,390 |
| Timber | 254,759 |
| Staves | 4,987 |
| Shingles | 67 |
| Ties, railroad | 76,090 |
| Hoop poles | 389 |
| Manufactured iron | 105 |
| Asphalt | 751 |
| General and miscellaneous | 22,293 |
| Total | 385,548 |

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[a] From Report Chief of Engineers, 1902, Part 3, App. H H, p. 1992.

*Gauge records, Evansville, Ind.*

| Year. | 8 feet and over. | 7 feet and over. | 6 feet and over. | 5 feet and over. | 4 feet and over. | 3 feet and over. | 2 feet and over. | 1 foot and over. |
|---|---|---|---|---|---|---|---|---|
|  | *Days.* | *Days.* | *Days.* | *Days.* | *Days.* | *Days.* | *Days.* | *Days.* |
| 1889 | 287 | 298 | 316 | 332 | 351 | 365 | 365 | 365 |
| 1890 | 327 | 337 | 351 | 359 | 365 | 365 | 365 | 365 |
| 1891 | 251 | 259 | 302 | 306 | 318 | 327 | 365 | 365 |
| 1892 | 220 | 222 | 235 | 262 | 289 | 312 | 334 | 366 |
| 1893 | 221 | 240 | 262 | 295 | 324 | 348 | 356 | 365 |
| 1894 | 188 | 192 | 201 | 215 | 244 | 253 | 270 | 331 |
| 1895 | 140 | 149 | 168 | 206 | 238 | 270 | 300 | 318 |
| 1896 | 287 | 318 | 339 | 341 | 346 | 366 | 366 | 366 |
| 1897 | 232 | 253 | 275 | 291 | 299 | 306 | 315 | 334 |
| Total | 2,153 | 2,268 | 2,449 | 2,607 | 2,769 | 2,912 | 3,036 | 3,175 |

NOTE.

(1) Low water at Lock No. 1, Green River, being reported as 2 feet above the lower miter sill, and extreme low water on Evansville gauge being slightly below the zero of the gauge, it follows that a stage of 4 feet and over on Evansville gauge would furnish the nearest stage (in even feet) for a comparison with stages of 6 feet and over at Lock No. 1, Green River. The period used for comparison is that from 1889 to 1897, both years inclusive.

Evansville gauge: $\frac{2,769 \text{ days}}{9 \text{ years}}$ = an average of 307.7 days in each year when the Evansville gauge indicated a stage of 4 feet or above.

Actual records at Lock No. 1, Green River, during the same period as above (see Report Chief of Engineers, 1897, App. E E, p. 2509), show that the average number of days when there was 6 feet or over on the lower miter sill was 304⅔ days.

(2) For convenience of comparison with published map (House Ex. Doc. No. 352, 53d Cong., 3d sess.), the low water on Evansville gauge has been taken at 0.1 foot. In 1895 (October 30 and 31), the gauge recorded –0.25 foot, or 0.35 foot below the plane shown on the profile.

Respectfully submitted.

R. R. JONES,
*Chief Assistant Engineer.*

Col. G. J. LYDECKER,
*Corps of Engineers, U. S. A.*

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## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

WASHINGTON, D. C., *February 23, 1904.*

GENERAL: In compliance with first indorsement, Office Chief of Engineers, dated December 21, 1903, the Board of Engineers for Rivers and Harbors, having reviewed the accompanying report of the district officer, has the honor to submit the following report on the proposed improvement of "Ohio River, below the mouth of Green River, with a view to the construction of a movable dam, so as to make a harbor at Henderson, Ky., and Evansville, Ind., and to give a depth of six feet on the lower miter sill on Lock Numbered One, Green River." On January 22, 1904, a committee of the Board held, at Evansville, Ind., a public hearing, at which interested parties submitted arguments in favor of the proposed improvement and presented written statements for record.

It is reported that the best location for a dam to fulfill the conditions named in the act is at a point about 7 miles below Henderson.

The benefits to be expected from the construction of the dam under consideration may be itemized as follows:

(*a*) To the commerce of Green River.
(*b*) To the harbors of Henderson, Ky., and Evansville, Ind.
(*c*) To the general commerce of the Ohio River.

*To the commerce of Green River.*—There is at low stages in the Ohio less depth upon the lower miter sill of Lock 1, and in the channel below Lock 1, Green River, than exists in the pools above this lock. The records show, however, that during a period of nine years, from 1889 to 1897, both inclusive, there was an average of over three hundred days per year in which the depth over the lower miter sill of Lock 1 was 6 feet or more. Depths in the channel below Lock 1 are not materially different from depths over the lower miter sill. Depths in the Ohio River are less than pool depths in Green River for several months each year. Evansville is perhaps the logical terminus of Green River navigation. The distance from the lower lock in Green River to Evansville is 17 miles following the Green and the Ohio rivers. It is obvious that an improvement of these two rivers from Evansville to Lock 1, Green River, such as would be produced by a dam below Henderson, would tend to cheapen transportation on Green River and probably give rise to an increased traffic. The commerce passing through Lock 1, Green River, is stated to be as follows:

| | Tons. |
|---|---|
| 1901 | 452,522 |
| 1902 | 385,548 |
| 1903 | 457,386 |

Of the total tonnage, about three-fourths consisted of lumber, timber, and railroad ties. Shipments of coal through Lock 1 were insignificant until 1903, when they amounted to 74,765 tons. Upon the Green River are five locks, and appropriation has been made for one additional. Upon the Barren, a tributary of the Green, one lock extends navigation to Bowling Green, Ky., and upon a second tributary, Rough River, a lock has been completed, affording navigable depths to Hartford, Ky. The Green River and its tributaries above mentioned comprise a slack-water system aggregating about 250 miles in length. The entire waterway traverses the western coal field of Kentucky, the production of which in 1900 was 3,096,097 tons. Other valuable mineral deposits exist and their future development may be anticipated. Evansville is one of the most important hardwood markets in the United States, and Green River furnishes a large proportion of its logs and lumber. There is also a considerable miscellaneous traffic upon Green River, packet boats plying regularly between Evansville and Bowling Green.

*To the harbors of Henderson, Ky., and Evansville, Ind.*—It appears that the depths now existing along the fronts of these towns are ample for the passage of craft that may reach there from above or below. The available channel depths in this reach are greater than in many others on the Ohio River. Nevertheless, if the water fronts of these towns were thrown into a pool, the facility with which coal and other freight might be handled at manufacturing plants on the water front of either town would be increased.

*To the general commerce of the Ohio River.*—About 40 miles of the river would be pooled by a dam below Henderson; certain shoals below Henderson and several immediately above Evansville would be drowned out, but it does not appear that the stretch that would be ameliorated is the worst between Louisville and Cairo that might be improved by a similar expenditure. Green River below Lock 1 is now largely utilized as an ice harbor for Ohio River shipping. It has been represented to the Board that the dam under consideration would facilitate the use of Green River for this purpose. It appears, however, that the necessity for lowering the dam when ice is running or forming rapidly would limit this advantage. It is probable that a pool in this vicinity, about halfway between Louisville and Cairo, would be of some service to through navigation by affording a harbor for tows caught by a falling river, though the natural existing pools largely answer the same purpose. To a limited extent the dam might serve as a sluice through which water might occasionally be drawn to increase temporarily depths upon the shoals below. The Board requested the views of the Pittsburgh Coal Exchange and of the Monongahela River Consolidated Coal and Coke Company as to the importance of the proposed improvement as affecting the through transportation of coal on the Ohio River, and their replies are as follows:

Replying to your favor of the 27th ultimo, in which you inquire as to the possible advantage of a lock and dam below Henderson, Ky., "to the towing of coal upon the Ohio River from the Davis Island pool to Mississippi River points," we beg to say doubtless the advantages to the commerce of Henderson, Evansville, and other points reached by the pooled waters of said lock and dam would be very considerable; but as the pooled waters will not reach the foot of the canal at Louisville, we can not conceive how the proposed lock and dam would benefit the shipping of coal; but as the proposed lock and dam will be a part of a continuous series from Louisville to Cairo, we favor the construction of the lock and dam, as do all coal shippers and navigators, so far as we are informed.

The pool formed above this dam will afford very valuable harborage, particularly in times of low water, for boats and tows returning from the far South.

Very respectfully,

THE PITTSBURGH COAL EXCHANGE,
By J. FRANK TILLEY, *Assistant Secretary.*

We have had under consideration your letter of the 27th ultimo, upon the matter of a proposed lock and dam below Henderson, Ky., and would say that we heartily favor the construction of the same. While this isolated dam may not aid the towing of coal very considerably upon the Ohio River until it is connected up with other pools, yet it will furnish valuable harborage in the pool formed above it for river craft during low water in that section of the river, and would permit an extensive river commerce to be carried on locally between points touched by the pooled waters made by this dam.

Very respectfully,

THE MONONGAHELA RIVER CONSOLIDATED COAL AND COKE CO.,
By J. FRANK TILLEY.

From these it appears that while both advocate the improvement on account of its local advantages and as a step toward the complete canalization from Louisville to Cairo, neither considers it of much value to the through coal traffic while forming an isolated pool.

The Board is forced to take cognizance of the fact that the slack-water improvement of the Ohio River from the mouth of the Big Miami to Cairo may in the future receive consideration. An important factor in the location of any lock and dam on the Ohio below the Falls at Louisville would be its location and character relative to a fully developed project for the canalization of the river. As no action has been taken by Congress looking to the complete canalization of this portion of the Ohio, the Board feels that in judging the merits of the proposed improvement it must be considered as an independent work.

The Board has had difficulty in reaching a conclusion as to the advisability of undertaking this work. The probability of an extension of the slack-water system below Louisville can not now be measured, and it seems proper for the Board to express no opinion upon the desirability of such an extension. Under existing conditions the safest course seems to delay, and the Board is constrained to the opinion that it is not now advisable to undertake the construction of "a movable dam, so as to make a harbor at Henderson, Ky., and Evansville, Ind., and to give a depth of 6 feet on the lower miter sill on Lock No. 1, Green River."

Respectfully submitted.

A. M. MILLER,
*Lieut. Col., Corps of Engineers.*
R. L. HOXIE,
*Major, Corps of Engineers.*
H. C. NEWCOMER,
*Captain, Corps of Engineers.*
W. V. JUDSON,
*Captain, Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

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## D D 9.

## PRELIMINARY EXAMINATION OF OHIO RIVER AT OGDEN LANDING, KENTUCKY.

[Printed in House Doc. No. 57, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith a report dated August 6, 1903, with map,[a] by Col. G. J. Lydecker, Corps of Engineers, on preliminary examination of Ogden Landing, Kentucky, on the Ohio River, with a view to ascertaining whether the construction of a wing dam is required in the interest of navigation. This examination was made pursuant to a requirement of the river and harbor act of June 13, 1902.

Colonel Lydecker states that improvement of the stream in this locality is necessary in the interest of general navigation and commerce, and is an essential part of the general open-river channel improvement under the existing project. He accordingly presents a scheme for rectification of the channel below Ogden Landing by dike construction and dredging. In his opinion, however, no special appropriation is necessary, as it would be better to deal with this special work in considering the project for expenditure of the next general appropriation for the whole river.

This report has been reviewed by the Board of Engineers for Rivers and Harbors under the provisions of sections 3 and 14 of the above-mentioned act, and in its report of August 19, 1903, the Board concludes that it is desirable for the United States to improve the Ohio River near Ogden Landing as a part of the general open-river project, but not otherwise, and that the appropriate time for beginning the work should be determined by the district officer, with the usual approval of higher executive authority.

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[a] Not reprinted; printed in House Document No. 57, Fifty-eighth Congress, second session.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, August 6, 1903.*

GENERAL: In compliance with Department letter of June 23, 1902, I have the honor to submit the following report on a preliminary examination called for by the river and harbor act of June 13, 1902, at "Ogden Landing, on the Ohio River, with a view to ascertaining whether the construction of a wing dam is required in the interest of navigation."

This landing is in Ballard County, Ky., on the left bank of the Ohio River, about 22.5 miles above its mouth, and is a place at which local packets touch for the convenience of those who have settled in the vicinity, a few on the river bank, but most of them in the country back of it. Its importance in a commercial sense is quite limited at present.

The low-water channel in front of Ogden Landing follows the Kentucky shore, and is an exceptionally good one; above and below this section the low-water channel lies toward the Illinois side of the river, and on both the upper and lower crossings the water is very shoal. These conditions are due to the fact that an extensive gravel bar projects from the Illinois shore opposite Ogden Landing, which causes a gradual concentration of the entire flow of water into a single narrow channel; but at the crossings above and below this bar there is no such contraction. The lower crossing is more troublesome in low water than the upper one, and leads into the "Grand Chain," which is a section of river where extensive improvements have been made in past years.

The general conditions referred to above are indicated on a small map that accompanies this report, but it is believed that the low-water depths shown on it represent a worse state of affairs at the crossings than actually exists at low-water periods. This is because the examination was made and soundings taken when the Mississippi River was much higher than the Ohio River, thereby causing backwater up the latter stream to such an extent that the reading of the Paducah gauge (22 miles above Ogden Landing) was then about 5 feet above low water. The soundings actually taken were reduced to correspond to the low-water reading of the Paducah gauge, and are so shown on the map. But, as a result of the backwater, there was no current in the Ohio River when the soundings were made, and, without doubt, a considerable deposit of light material then existed in its bed in that locality. Experience shows that much of this material would be washed out by the current before the river reached its usual low-water stage, and afford much better depths of channel on the crossings at that stage than the map indicates.

There can be no question that improvement of both crossings is necessary in the interests of general navigation and commerce, or that the work incident to such improvement is directly appropriate to, and an essential part of, the general open-river channel improvement under the existing project that has been in force for many years; for this reason no special appropriation for improving that immediate locality (in preference to others that may require more immediate attention) is necessary or desirable, and it would be better to deal with this special work in considering the project for expending the next general appropriation for the whole river, rather than make any mandatory provision in that appropriation for applying any specific part of it to this special locality.

It is proper to say in concluding this report that present information indicates the following scheme of work as the most desirable when improvement of this locality is taken up: First, to construct a dam from the Kentucky shore at or near the point "C" shown on the map, thereby blocking the large flow that passes on that side of the extensive middle-ground bar and diverting it into the crossing and channel on the Illinois side at the head of the "Grand Chain;" second, to extend a wing dam from the Illinois side at a point near the head of "Grand Chain," and perhaps another between it and the old crib dike of 1879-1884, the precise location of dikes to be left for determination after careful study of actual low-water conditions rather than with reference to those indicated on the map now submitted. It is quite likely that some dredging, and perhaps the removal of some rock, may be required also, but it is believed that a radical improvement of this crossing can be accomplished in accordance with this general project at a cost that will range from sixty to seventy-five thousand dollars. Improvement of the upper crossing is not believed to be of such immediate importance as that of the lower one, though it is probable that some dredging and one or two wing dams may be eventually required there also.

A report prepared by Chief Assistant Engineer R. R. Jones * * * is submitted herewith, and contains details on which the conclusions expressed herein are largely predicated; though I have also made close personal examination of the locality in question, but not under such appropriate river conditions as I should desire.

Very respectfully, your obedient servant,

G. J. Lydecker,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

[First indorsement.]

Office Chief of Engineers, U. S. Army,
*August 11, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., August 19, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of "Ogden Landing, on the Ohio River, with a view to ascertaining whether the construction of a wing dam is required in the interest of navigation," and other data available.

There are two existing projects for the improvement of the Ohio River. The first relates to that portion of the river which lies between Pittsburg and the mouth of the Big Miami, and has for its object to obtain a low-water depth of 6 feet by the construction of 38 locks and movable dams, and by certain incidental work. The other project refers to the entire length of the river, and its general purpose is to increase the depth of the low-water channel and to improve it in other respects for safe and convenient open-river navigation. For work under the second project the river and harbor act of June 13, 1902, appropriated $400,000. For work under the first project $523,000 was appropriated, and contracts in the additional sum of $1,750,000 were authorized.

Ogden Landing is about 22.5 miles above the mouth of the Ohio and a long distance below the lower limit of the work included in the canalization project. Work at this place, therefore, would have to be the subject of a special appropriation or be carried out as a part of the open-river project.

The Board agrees with the district officer that the removal of the obstructions near Ogden Landing is not sufficiently urgent to justify a special appropriation, and that the necessary work should be done as a part of the general project with due regard to its relative importance as compared with the other elements of that project. The particular means to be employed in improving the crossings near Ogden Landing should be determined just prior to beginning work.

It is therefore the opinion of the Board that it is desirable for the United States to improve the Ohio River near Ogden Landing as a part of the general open-river project, but not otherwise; and that the appropriate time for beginning the work should be determined by the district officer, with the usual approval of higher executive authority.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of Board.*

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## REPORT OF MR. R. J. JONES, CHIEF ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, March 26, 1903.*

COLONEL: The river and harbor act of June 13, 1902, by section 14, * * * provides for the making of certain preliminary examinations or surveys, and among the various localities enumerated under the heading "Kentucky" is the following:

"Ogden Landing, on the Ohio River, with a view to ascertaining whether the construction of a wing dam is required in the interests of navigation."

An examination of the locality in question was made during the month of October, 1902, the result of which is embodied in a blue-print map hereto attached, and a report[a] from Mr. J. Nelson Caldwell, assistant engineer. In addition to the information contained in the report and map, I have compiled other data which seem to have a bearing on the subject, and this is now respectfully submitted, together with a suggested scheme for improvement.

*Ogden Landing* is situated in Kentucky, on the left bank of the Ohio, about 942.5 miles below Pittsburg and a little more than 1 mile above the Grand Chain. Directly opposite the public wharf at Ogden Landing the low-water depth of the river is greater than for some miles above and below. At the crossing above this comparatively deep pool the water for a short distance shoals to less than 2 feet, but at a point about 2,000 feet above the landing it again deepens to 3 feet or more. Below the Ogden Landing the channel has a low-water depth of 4 feet or more for a distance of about 4,000 feet, and then shoals gradually to less than 1 foot at a point about 6,600 feet below the landing.

From the foregoing it will be seen that the depth of low-water channel of the Ohio opposite Ogden Landing is good, but that shoal water is found both above and below, notably, in the latter case, the head of the Grand Chain.

*Grand Chain.*—As shown by the earliest guides to navigators on the Ohio, this locality, extending from about 943 to 948 miles below Pittsburg, has for many years been more or less dangerous. A rocky foundation, sometimes described as the remains of a prehistoric chain of hills, crosses the Ohio at an oblique angle, on a line extending from northeast to southwest. The Navigator, a pilot's guide first published in 1801, shows the channel at Grand Chain nearly in the middle of the river, and it mentions in particular two dangerous rocks to be avoided. Colonel Merrill (Report, Chief of Engineers, 1877, Part I, p. 626) states that in 1829 and 1830 a large number of rocks was removed at this point by a party under direction of Capt. Henry M. Shreve, then superintendent of Government works on western rivers. Colonel Merrill caused careful surveys of Grand Chain to be made in 1872 and 1874. He also removed Jackson rock during the season of 1876. This rock or collection of rocks lay in what is now the low-water channel of the river, about 500 feet below the root of the present crib dike at the head of the chain.

The river and harbor act of June 18, 1878, provided the sum of $50,000 for removing obstructions and deepening the channel at Grand Chain. Under this appropriation the group of rocks known as "Arkansas rock," situated in the present low-water channel, about 900 feet above the root of the crib dike at head of the chain, was removed by surface blasting, at a cost of $18.38 per cubic yard. Colonel Merrill, in his report for the fiscal year 1879, outlines a comprehensive treatment for Grand Chain, which included the fencing off of the main ledge by dikes and the removal of isolated rocks considered specially dangerous. This project was carried out by the removal, in 1880, of "Grenadier rock," lying on the Illinois side of the channel, about 3,400 feet above the head of the crib dike at the head of the chain, and by the construction of three crib dikes extending from the Illinois shore, the uppermost one of which was completed between the years 1879 and 1884. It would appear that the original plan for these dikes contemplated rather the fencing off of the main rock ledges, and so diverting the current, rather than any material contraction of the channel or the increase of its depths. In the latter respect, however, there has been some improvement directly opposite the dikes.

A short distance (800 to 1,800 feet) below Ogden Landing the low water is more contracted than above or below, having a width varying from 1,500 to 1,900 feet. At a point about 8,400 feet below Ogden and 2,500 feet above the root of the dike at head of Grand Chain the low-water width from shore to shore is about 4,100 feet, but the width is partly filled by a bar, which rises to about 2 feet above low water, leaving channels on both sides. The Illinois channel is the only one practicable for boats at extreme low-water stages. Opposite the foot of the dike already alluded to and below the bar the width of the river is only 2,700 feet. In the wider portion of the river, 2,500 feet above the root of the dike, the low-water channel is crooked as well as shallow, and this is the locality which seems to be in most pressing need of rectification.

*Suggested improvements.*—The scheme suggested for the improvement of this crooked and shallow channel above the crib dike, built in 1879–1884, contemplates the contraction of the river and diversion of channel, by means of three dikes built of loose stone, located at points marked respectively A and B on the Illinois shore and C on the Kentucky shore. It further proposes the removal by dredging, in case the scouring effected by contraction is insufficient, of a portion of the bar directly at the ends of the two dikes which it is proposed to extend from the Illinois shore. Previous experience has shown that the scouring of the channel sometimes exposes isolated rocks or hard gravel which, to be removed, requires blasting and dredging.

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[a] Not printed.

For the dikes at A and B a height of 6 feet above low water is proposed, while the dike at C is to rise only to the level of low water, such low elevation being proposed so that this dike may offer no obstruction to the passage of tows when the river permits crossing the bar itself.

*Cost of proposed improvement.*

| | |
|---|---|
| Dike A | $18,200 |
| Dike B | 18,400 |
| Dike C | 5,000 |
| Dredging 98,000 cubic yards, at 20 cents | 19,600 |
| Total | 61,200 |

It is believed that the construction of the works above described, with the dredging also provided for, would both straighten and deepen the crossing below Ogden Landing, and would have the merit of constituting an improvement from which the general navigation of the river would derive material benefit.

Very respectfully,

R. J. Jones,
*Chief Assistant Engineer.*

Col. G. J. Lydecker,
*Corps of Engineers.*

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## D D 10.

## ESTABLISHMENT OF HARBOR LINES ALONG THE OHIO RIVER AT STEUBENVILLE AND MINGO, OHIO.

National Tube Company,
Riverside Department,
*Wheeling, W. Va., June 26, 1901.*

Whereas there is an act of Congress prohibiting the dumpage of any material over the river bank of the Ohio outside the harbor lines; and

Whereas no definite harbor lines have been established at the city of Steubenville;

Therefore, we, the undersigned, having interests involved therein, beg leave to point out that under present conditions certain rights accruing to us as property owners are thereby withheld.

We explicitly disclaim any wish to trespass on any water rights considered necessary to the proper preservation of the river, yet, as property owners, and as incorporated bodies, we undoubtedly have certain riparian rights, which are quite undefined, but which should not be arbitrarily taken away. We therefore think it proper to request that these rights be speedily defined by the only power competent to define them, viz, the United States Harbor Survey, and the one which has the necessary data to enable them to make a just decision between conflicting views, and with a due regard to the necessities of river preservation and land transportation.

Now, therefore, we beg leave to petition the honorable Secretary of War that he authorize the office of the United States Survey to proceed with the establishment of harbor lines at the city of Steubenville, from a point below the property of La Belle Iron Works to a point above the city waterworks.

National Tube Company,
By F. J. Hearne, *President.*

The Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*July 30, 1901.*

Respectfully referred to Maj. W. H. Bixby, Corps of Engineers, for consideration and report, in accordance with the provisions of section 11 of the river and harbor act of March 3, 1899.

If considered necessary Major Bixby is authorized to hold a public hearing after due notice to interested parties.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Third indorsement.]

U. S. ENGINEER OFFICE,
*Cincinnati, Ohio, October 3, 1901.*

Respectfully returned to the Chief of Engineers, copies having been made for the use of this office.

A preliminary report was submitted separately August 31, and a full report will be forwarded in like manner later, after all the principal parties concerned shall have returned the blueprints and furnished the information alluded to in my preliminary report, as necessary before the holding of a public hearing.

The La Belle Iron Works and the city and county authorities are yet to be heard from.

W. H. BIXBY,
*Major, Corps of Engineers.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 8, 1901.*

Respectfully returned to the Secretary of War:

Application is made by the National Tube Company of Wheeling, W. Va., for establishment of harbor lines in Ohio River at Steubenville, Ohio.

The local officer, Maj. W. H. Bixby, Corps of Engineers, has submitted a preliminary report[a] on the subject, dated August 31, 1901, herewith, from which it appears that it is intended to hold a public hearing which is being deferred until the views of interested parties can be obtained.

In a further report, in third indorsement hereon, Major Bixby states that full report will be submitted after information called for by him shall have been furnished by local interests.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*January 21, 1902.*

Respectfully returned to the Secretary of War.

The nature of this case is stated in a preceding (fourth) indorsement, and a further report in the matter by Major Bixby is herewith.

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[a] Not printed.

From this report it appears that, for the reasons given, the proposed public hearing has not been held; but Major Bixby has selected certain lines, described at length in his report and delineated upon the accompanying chart, which he recommends for approval.

It is recommended that the harbor lines indicated be approved as to the general plan, but that before their final adoption by the Secretary of War the papers be returned to the local officer with instructions that the question of harbor lines at Steubenville be considered at a public hearing at that place, at which all interested parties, after proper notice, shall be given an opportunity to be heard; that the lines agreed upon at such meeting shall be definitely determined by references and benches; and that with his final report in the matter tracings be submitted showing the proposed lines, with such references and description thereon as will serve for their ready identification, the lines to be located permanently on the ground after adoption. It is further recommended that any expense connected with the work above indicated, if authorized, be paid from the appropriation for improving Ohio River.

In letter[a] of October 24, 1901 (herewith), the National Tube Company expresses a desire to be advised by the Secretary of War of any additional information in this case.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Seventh indorsement.]

WAR DEPARTMENT,
*February 15, 1902.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Eighth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 20, 1902.*

Respectfully referred to Col. G. J. Lydecker, Corps of Engineers, inviting attention to the foregoing (sixth and seventh) indorsements.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Ninth indorsement.]

U. S. ENGINEER OFFICE,
*Cincinnati, Ohio, May 8, 1902.*

Respectfully returned to the Chief of Engineers, United States Army.

The hearing required by the sixth and seventh indorsements hereon, was held at Steubenville, Ohio, April 10, 1902, and a record of the proceedings[a] is herewith.

The understanding reached was that the lines, when finally established, will conform, in general plan, to those recommended and approved by the indorsements above referred to. They appear to be accepted as a fair compromise by the several representatives of conflicting interests.

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[a] Not printed.

The board of commissioners of Jefferson County was greatly concerned respecting the space left available at certain points inside of the proposed line for the public highway. It was represented that the established width of roadway, and that needed for traffic, had become seriously reduced by encroachments by the railways on one side and erosion of the river bank on the other. This matter was made a subject of further special consideration, as indicated in the appendix[a] to the record of the public hearing, and finally satisfactorily determined at an interview in this office with the president and engineer of the board on the 1st instant.

The stage of water has thus far been too high to permit the field work required for placing monuments to mark the line. This will be done as soon as practicable, and a tracing showing the line so established will then be submitted for final action.

The blueprint showing the general line is retained in this office for further reference, the other inclosures[a] received with the eighth indorsement are returned herewith. * * * A copy of the report[a] from the American Association of Masters and Pilots, Harbor No. 25, Pittsburg, Pa., which was read at the public hearing, is also herewith as an additional inclosure.

G. J. Lydecker,
*Colonel, Corps of Engineers,*

[Tenth indorsement.]

War Department,
Office of the Chief of Engineers,
*Washington, October 29, 1903.*

Respectfully returned to the Secretary of War.

The harbor lines along the Ohio River, in the vicinity of Steubenville, Ohio, which were approved as to their general plan by the Assistant Secretary of War in seventh indorsement hereon, have now been definitely determined after a field survey and public hearing as authorized by the Secretary. The lines thus selected have been located on the ground and are delineated on the accompanying tracing.[a]

It is believed that these lines will best subserve the various interests involved, and I recommend their formal adoption by the Secretary of War. I further recommend that the Secretary place his approval upon the tracing submitted, which has been prepared for his signature.

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Eleventh indorsement.]

War Department,
*October 30, 1903.*

The harbor lines selected are approved.

Robert Shaw Oliver,
*Acting Secretary of War.*

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[a] Not printed.

## REPORT OF MAJ. W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, January 13, 1902.*

GENERAL: As required by instructions of second indorsement of July 30, 1901, upon the letter of the National Tube Company, Riverside Department, Wheeling, W. Va., dated June 26, 1901, as well as in accordance with the instructions of your letter[a] of the 7th instant on the same subject, I have herewith to submit a full report on these harbor lines.

* * * * * * *

It is therefore recommended that for the Ohio River from Steubenville to Mingo the harbor lines be located in plan as shown on the accompanying blueprint[a] and be established in height at 40 feet above dead low water, low water to be based on the records of the Cincinnati office, and that the harbor slopes be made everywhere 1 foot vertically to 3 feet horizontally, thus locating the dead low-water lines 120 feet distant from the harbor lines and parallel thereto, these arrangements to be effective on both banks of the river from the upper end of Steubenville to the lower end of Mingo, and that should these harbor lines be advanced farther toward the river either now or subsequently the advance must be not over 30 feet toward the river in any one place, and the party permitted to make such advance shall be required to first dredge from the river channel in front a volume of material equal to the volume to be filled in by the advance, so as to keep the area of river cross section unchanged.

After the harbor lines, as laid down on the accompanying blue print, shall have been acted upon by the honorable Secretary of War it will be necessary to transfer these lines as finally approved or ordered to the ground itself, and to place suitable monuments and benches by which the approved harbor lines may be readily recognized and conformed to by the riparian owners and other parties interested. At the same time this work is done it will probably be found that in some minor details the accompanying river survey map,[a] made originally for other purposes, will need slight corrections as regards minor details, and the harbor lines will need slight adjustment thereto.

This work will necessarily require a special survey and several months' time. It is therefore requested that after action by the War Department upon this report and blue print[a] the latter be returned to this office and authority be given for the subsequent necessary fieldwork for the establishment of the lines in place. When such lines have been so established, additional sheets and drawings in detail will be resubmitted, giving precise descriptions by which all points of lines may be accurately located and referred to, both in the field and in the office.

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Very respectfully, your obedient servant,

W. H. BIXBY,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

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[a] Not printed.

## REPORT OF COL. G. J. LYDECKER, CORPS OF ENGINEERS.

United States Engineer Office,
*Cincinnati, Ohio, July 8, 1903.*

General: Referring to * * * [the application of the National Tube Company, of Wheeling, W. Va., for establishment of harbor lines in Ohio River at Steubenville, Ohio], which was returned to the Department May 8, 1902, I have now the honor to forward in a separate roll by this mail, tracing[a] (in duplicate) showing harbor lines covering a section of the Ohio River, on both sides, for a distance of about 6.8 miles in the vicinity of Steubenville, Ohio, definitely located with references as indicated in sixth indorsement on the paper above referred to.

The line on each side is a series of tangents and connecting circular arcs, and is located in substantial conformity with the lines shown on the blueprint[a] submitted by Maj. W. H. Bixby, Corps of Engineers, with his report of January 13, 1902, being the lines previously approved by the seventh indorsement on * * * [application above referred to]. Slight modifications were made at a few localities, either to harmonize opposing contentions that were developed at the public hearing, or to better conform with actual conditions shown by the special survey for definite location.

The fieldwork that was a necessary preliminary to the preparation of the map of definite location was in progress during the low-water season last year, and completed December 29, 1902. In connection with this fieldwork all junction points of tangents and curves, and many intermediate points, were marked by iron pins driven into the ground with tops below the surface, and their positions indicated by neighboring witness posts that are planted 3 feet in the ground and project 1 foot above it.

I recommend final adoption of the lines shown on the tracing,[a] and, if this be done, that one copy of the tracing with formal approval be returned to this office for official custody and use.

The blueprint showing the lines that were previously approved is returned in the same roll that contains the tracings.

Very respectfully, your obedient servant,

G. J. Lydecker,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

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## D D II.

## ESTABLISHMENT OF HARBOR LINES ALONG THE OHIO RIVER FROM ASHLAND, KENTUCKY, TO HANGING ROCK, OHIO.

The undersigned pilots and masters of steam vessels navigating the Ohio River between Pittsburg and Cincinnati, respectfully call your attention to the fact:

(1) That the channel of the Ohio River at the foot of Pogue's Shal-

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[a] Not printed.

lows, between the towns of Ashland and Russell, Ky., has been diverted from its proper course and caused to flow adjacent to and over a reef of rocks next to the Kentucky shore.

(2) That by such diversion of the channel navigation has been endangered.

(3) That the old channel has been completely filled up, compelling steamboats to run close to and over the reef of rocks above mentioned.

(4) That this diversion of the channel has been, and is now being caused, by a cinder fill lining the Ohio shore at Sarah and Etna furnaces, in the upper part of the city of Ironton.

(5) That said cinder fill is being constantly added to from the cinder output of said furnaces, and encroaches more and more into the river bed.

(6) We respectfully ask that steps be taken whereby the channel may be redirected to its old course, the throwing or dumping of cinders over the river brink be stopped, and the accumulated deposits removed.

T. T. JOHNSON,
and 13 others.

The SENATORS AND REPRESENTATIVES
OF THE UNITED STATES IN CONGRESS ASSEMBLED.

[SEAL.] AMERICAN ASSOCIATION MASTERS AND PILOTS
OF THE UNITED STATES.

WILLIAM F. BROOKHART,
*Captain, Harbor No. 26.*
BEN M. MERRILLEES, C. C.,
*Harbor No. 26, Cincinnati, Ohio.*

Respectfully [referred] to [the] Chief [of] Engineers, United States [Army], with request for action to prevent injury.

A. S. BERRY, M. C.

FEBRUARY 3, 1898.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 3, 1898.*

Respectfully referred to Maj. W. H. Bixby, Corps of Engineers, for early examination, report, and recommendation.

To be returned.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
*Lieut. Col., Corps of Engineers.*

[Second indorsement.]

U. S. ENGINEER OFFICE,
*Cincinnati, Ohio, February 16, 1898.*

Respectfully returned to the Chief of Engineers, United States Army, with report as follows:

Numerous iron furnaces scattered along more than a mile of the river front of Ironton, Ohio, have for many years been dumping their refuse (slag, cinders, etc.) into the Ohio River until the Ohio bank has in some cases been built out nearly 150 feet. There is little doubt but that this has to some extent changed the flow of water in the river in time of freshets and assisted the present erosion of the Kentucky bank near Russell. Unless this advance of the Ohio bank be stopped, more serious results are likely to follow. This advance is such a general one that it can hardly be stopped except by the establishment of so-called "harbor lines" along this stretch of river as far as the iron furnaces are likely to be built, say 4 to 5 miles.

I therefore recommend a careful local survey of the Ohio River near Ironton, to cost from $1,000 to $1,500, to be followed by the establishment of harbor lines along the same.

A fuller report by Lieut. W. B. Ladue, together with blue print of a hasty sketch[a] of this locality, is herewith inclosed.

W. H. Bixby,
*Major, Corps of Engineer.*

[Third indorsement.]

Office Chief of Engineers, U. S. Army,
*February 19, 1898.*

Respectfully returned to Major Bixby, who is authorized to make the survey recommended by him in second indorsement hereon, with a view to the establishment of harbor lines at the locality.

To be returned.

By command of Brig. Gen. Wilson:

A. Mackenzie,
*Lieut. Col., Corps of Engineers.*

[Fourth indorsement.]

U. S. Engineer Office,
*Cincinnati, Ohio, February 21, 1898.*

Respectfully returned to the Chief of Engineers, United States Army, the necessary record having been made.

W. H. Bixby,
*Major, Corps of Engineers.*

[Fifth indorsement.]

Office Chief of Engineers, U. S. Army,
*February 8, 1902.*

Respectfully submitted to the Secretary of War.

Parties interested in the navigation of the Ohio River have presented through Representatives in Congress the within petition, that steps be taken to prevent changes in the direction of the river channel in the vicinity of Ashland and Russell, Ky., by means of the dumping of cinders and other materials over and along the river banks. In the opinion of the local engineer officer the remedy sought is in the establishment of harbor lines at the locality named, and investigation has been made with that end in view.

Inviting attention to Major Bixby's report of the 14th ultimo, herewith, I would respectfully recommend that the lines selected and indicated on the blueprint[a] accompanying same, which extend for about

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[a] Not printed.

10 miles along the Ohio River from Ashland, Ky., to Hanging Rock, Ohio, be approved as to the general plan, but that before their final adoption by the Secretary of War the papers be returned to the local officer with instructions to have the lines definitely determined by references and benches, and with his final report in the matter to submit tracings showing the proposed lines with such description thereon as will serve for their ready identification, the lines to be located permanently on the ground after adoption.

It is further recommended that any expense connected with the work above indicated, if authorized, be paid from the appropriation for improving Ohio River.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Sixth indorsement.]

WAR DEPARTMENT,
*February 15, 1902.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 20, 1902.*

Respectfully referred to Col. G. J. Lydecker, Corps of Engineers, inviting attention to the foregoing (fifth and sixth) indorsements.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Eighth indorsement.]

U. S. ENGINEER OFFICE,
*Cincinnati, Ohio, July 8, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, with tracing[a] (in duplicate) showing the proposed harbor lines definitely located, as required by the first indorsement hereon.

The line on each side is a series of tangents and connecting circular arcs, and is laid down so as to conform as nearly as practicable with the lines shown on the blueprint submitted by Maj. W. H. Bixby, Corps of Engineers, with his report dated January 14, 1902, being the lines provisionally approved by sixth indorsement hereon.

The fieldwork for locating the lines on the ground and connecting them with trasverse line of the general survey of the Ohio River from Marietta to mouth of Big Miami River was in progress during the low-water season of 1902 and completed October 3, 1902. In connection with this work all junction points of tangents and curves, and many intermediate points as shown on the tracing, were marked by iron pins driven into the ground with tops below the surface, and their position indicated by neighboring witness posts that are planted 3 feet in the ground and project 1 foot above the surface.

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[a] Not printed.

I recommend the lines shown on the tracing for final adoption, and, if this be done, that one of the duplicate tracings, duly approved, be returned to this office for official custody and use.

G. J. LYDECKER,
*Colonel, Corps of Engineers.*

[Eleventh indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, October 30, 1903.*

Respectfully returned to the Secretary of War.

The harbor lines along the Ohio River for about 10 miles from Ashland, Ky., to Hanging Rock, Ohio, which were approved as to their general plan by the Assistant Secretary of War in sixth indorsement hereon, have now been definitely determined after a field survey, as authorized by him. The lines thus selected have been located on the ground and are delineated upon the accompanying tracing.[a]

It is believed that these lines are well adapted to the preservation of the river channel, and I recommend their formal adoption by the Secretary of War. I further recommend that the Secretary place his approval upon his tracing submitted, which has been prepared for his signature.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Twelfth indorsement.]

WAR DEPARTMENT,
*October 31, 1903.*

The harbor lines selected are approved.

ROBERT SHAW OLIVER,
*Acting Secretary of War.*

### REPORT OF MAJ. W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Cincinnati, Ohio, January 14, 1902.*

GENERAL: I have herewith to submit a blueprint map[a] and report upon the establishment of harbor lines at Ashland and Ironton, extending past Russell down to Hanging Rock, these harbor lines being those whose establishment was recommended by my second indorsement of February 16, 1898, as approved by Department third indorsement of February 19, 1898, upon the request of pilots and masters of harbor 26, Cincinnati, as forwarded by Hon. A. S. Berry, February 3, 1898, asking for a regulation of the harbor of the Ohio River at Ashland and Russell.

* * * * * * *

It is therefore recommended that for the Ohio River from Ashland to Hanging Rock the harbor line be located in plan as shown on the accompanying blueprint, and be established in height at 56 feet above dead low water, low water to be based on the records of the Cincinnati office, and that the harbor slopes be made everywhere 1 foot vertically to 3 feet horizontally, thus locating the dead low-water lines 168 feet distant from the harbor lines and parallel thereto, these arrangements to be effective on both banks of the river from Ashland to Hanging Rock, and that should these harbor lines be advanced farther toward the river either now or subsequently the advance must be not over 30 feet toward the river in any one place, and the party permitted to make such advance shall be required to first dredge from the river channel in front a volume of material equal to the volume to be filled in by the advance so as to keep the area of river cross section unchanged.

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[a] Not printed.

After the harbor lines as laid down on the accompanying blueprint shall have been acted upon by the honorable Secretary of War, it will be necessary to transfer these lines as finally approved or ordered to the ground itself, and to place suitable monuments and benches by which the approved harbor lines may be readily recognized and conformed to by the riparian owners and other parties interested. At the same time this work is done it will probably be found that in some minor details the accompanying river survey map, made originally for other purposes, will need slight corrections as regards minor details, and the harbor lines will need slight adjustment thereto. This work will necessarily require a special survey and several months' time. It is therefore requested that after action by the War Department upon this report and blueprint, the latter be returned to this office and authority be given for the subsequent necessary fieldwork for the establishment of the lines in place. When such lines have been so established additional sheets and drawings in detail will be resubmitted, giving precise descriptions by which all points of lines may be accurately located and referred to, both in the field and in the office.

Very respectfully, your obedient servant,

W. H. Bixby,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

# APPENDIX E E.

## IMPROVEMENT OF HARBOR AT PITTSBURG, PENNSYLVANIA; OF ALLEGHENY RIVER, PENNSYLVANIA; OF MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA; CONSTRUCTION OF LOCKS AND MOVABLE DAMS NOS. 2-7, OHIO RIVER, AND OPERATING AND CARE OF DAVIS ISLAND DAM, OHIO RIVER.

*REPORT OF MAJ. WM. L. SIBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. Monongahela River, West Virginia.
2. Monongahela River, Pennsylvania.
3. Operating and care of locks and dams, Monongahela River, West Virginia and Pennsylvania.
4. Harbor at Pittsburg, Pennsylvania.
5. Operating and care of Davis Island dam, Ohio River, near Pittsburg, Pennsylvania.
6. Construction of Locks and Dams Nos. 2-7, Ohio River, Pennsylvania.
7. Construction of locks and dams at Herr Island, above head of Six-mile Island, and at Springdale, Allegheny River.
8. Operating and care of Herr Island dam (No. 1), Allegheny River, Pennsylvania.
9. Allegheny River, Pennsylvania.

### EXAMINATIONS.

10. Beaver River, Pennsylvania.
11. Cheat River, West Virginia.
12. Monongahela River, Pennsylvania, Locks and Dams Nos. 1, 3, 4, and 5.

### HARBOR LINES.

13. Monongahela River at McKeesport, Pennsylvania.
14. Monongahela River at Dam No. 2, Port Perry, Pennsylvania.
15. Ohio River, from Davis Island dam to Dam No. 3, Pennsylvania.

United States Engineer Office,
*Pittsburg, Pa., July 15, 1904.*

General: I have the honor to forward herewith annual reports of works under my charge for the year ending June 30, 1904.

Very respectfully, your obedient servant,

Wm. L. Sibert,
*Major, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## E E 1.

## IMPROVEMENT OF MONONGAHELA RIVER, WEST VIRGINIA.

A detailed description of the work done during the fiscal year ending June 30, 1904, will be found in the attached report of Assistant Engineer J. L. Callard.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $349,060.50 |
| Amount appropriated by sundry civil act approved April 28, 1904 | 100,000.00 |
| | 449,060.50 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 341,491.76 |
| July 1, 1904, balance unexpended | 107,568.74 |
| July 1, 1904, outstanding liabilities | 4,581.53 |
| July 1, 1904, balance available | 102,987.21 |
| July 1, 1904, amount covered by uncompleted contracts | 23,285.65 |

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### APPROPRIATIONS.

| | |
|---|---|
| June 10, 1872, improving Monongahela River between Morgantown and New Geneva | $25,000 |
| March 3, 1873, improving upper Monongahela River near Morgantown, W. Va | 66,000 |
| June 23, 1874, improving upper Monongahela River near Morgantown, W. Va | 25,000 |
| March 3, 1875, improving upper Monongahela River near Morgantown, W. Va | 22,000 |
| June 18, 1878, improving Monongahela River, West Virginia and Pennsylvania | 25,000 |
| March 3, 1879, improving Monongahela River, West Virginia and Pennsylvania | 24,000 |
| June 14, 1880, improving Monongahela River, West Virginia | 25,000 |
| March 3, 1881, improving Monongahela River, Pennsylvania and West Virginia | 25,000 |
| August 2, 1882, improving Monongahela River, West Virginia | 25,000 |
| July 5, 1884, improving Monongahela River, West Virginia | 45,000 |
| August 5, 1886, improving Monongahela River, Pennsylvania and West Virginia | 90,900 |
| August 11, 1888, improving Monongahela River, West Virginia | 35,000 |
| September 25, 1889 (allotment) | 4,000 |
| July 13, 1892, improving Monongahela River, West Virginia | 25,000 |
| August 18, 1894, improving Monongahela River, West Virginia and Pennsylvania | 20,000 |
| June 3, 1896, improving upper Monongahela River, West Virginia | 30,000 |
| June 4, 1897, improving upper Monongahela River, West Virginia | 350,000 |
| July 1, 1898, improving upper Monongahela River, West Virginia | 400,000 |
| June 28, 1902, improving Monongahela River, West Virginia | 350,000 |
| April 28, 1904, improving Monongahela River, West Virginia | 100,000 |
| Total | 1,711,900 |

## ABSTRACT OF CONTRACTS IN FORCE.

### *Completing Locks and Dams 10 and 11, Monongahela River.*

Contractors: Baker & Judson, Gloversville, N. Y.

Rates: Original contract. Grubbing and clearing, $200 lump bid; earth excavation, 50 cents per cubic yard; hardpan excavation, $1.25 per cubic yard; rock excavation, $3 per cubic yard; embankment, 30 cents per cubic yard; concrete, $7.25 per cubic yard; stone ballast in cribs, $2 per cubic yard; stone paving, $2.50 per square yard; timber for gates, spars, quoins, and sills, $80 per M feet B. M.; timber for cribs, class A, $30 per M feet B. M.; timber for cribs, class B, $60 per M feet B. M.; driftbolts, 5 cents per pound; screw bolts, 5 cents per pound.

Rate: Supplemental contract. Broken stone in drain at Lock No. 11, $2 per cubic yard.

Date of approval: Original, June 3, 1901; supplemental, July 7, 1902.

Date of beginning: June 26, 1901.

Date of expiration: June 26, 1903 (extended for a reasonable period).

### *Building Locks and Dams 12 and 13, Monongahela River.*

Contractor: The T. A. Gillespie Company, Pittsburg, Pa.

Rates: Original contract. Grubbing and clearing, $500 lump bid; earth excavation, 40 cents per cubic yard; hardpan excavation, $1 per cubic yard; rock excavation, $1.50 per cubic yard; embankment, 30 cents per cubic yard; concrete, $8.10 per cubic yard; stone ballast in cribs, $2 per cubic yard; stone paving, $2.25 per square yard; timber for gates, spars, quoins, and sills, $88 per M feet B. M.; timber for cribs, class A, $50 per M feet B. M.; timber for cribs, class B, $50 per M feet B. M.; driftbolts, 4 cents per pound; screw bolts, 4 cents per pound.

Rate: Supplemental contract. Broken stone in drains at Locks Nos. 12 and 13, $2 per cubic yard.

Date of approval: Original, May 3, 1901; supplemental, July 7, 1902.

Date of beginning: May 24, 1901.

Date of expiration: May 24, 1903 (extended for a reasonable period).

### *Building Locks and Dams 14 and 15, Monongahela River.*

Contractor: The T. A. Gillespie Company, Pittsburg, Pa.

Rates: Original contract. Grubbing and clearing, $500 lump bid; earth excavation, 60 cents per cubic yard; hardpan excavation, 75 cents per cubic yard; rock excavation, $2 per cubic yard; embankment, 50 cents per cubic yard; concrete, $8.10 per cubic yard; stone ballast in cribs, $2 per cubic yard; stone paving, $2 per square yard; timber for gates, spars, quoins, and sills, $90 per M feet B. M.; timber for cribs, class A, $40 per M feet B. M.; timber for cribs, class B, $50 per M feet B. M.; driftbolts, 4 cents per pound; screw bolts, 5 cents per pound.

Rate: Supplemental contract. Broken stone in drains at Locks Nos. 14 and 15, $2 per cubic yard.

Date of approval: Original, July 18, 1901; supplemental, July 7, 1902.

Date of beginning: August 5, 1901.

Date of expiration: August 5, 1903 (extended for a reasonable period).

### *Building a dwelling at each of Locks 11, 12, and 13, Monongahela River.*

Contractor: Thomas J. Williams, Pittsburg, Pa.

Rate: $2,890 each.

Date of approval:[a]

Date of beginning work: December 15, 1902.

Date of expiration: May 15, 1903 (extended for a reasonable period).

### *Building a dwelling at Lock 15, Monongahela River.*

Contractor: Thomas J. Williams, Pittsburg, Pa.

Rate: $3,000.

Date of approval:[a]

Date of beginning work: January 2, 1903.

Date of expiration: June 2, 1903 (extended for a reasonable period).

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[a] Emergency.

*Building a dwelling at Lock 14, Monongahela River.*

Contractor: Kammerer & Kern, Morgantown, W. Va.
Rate: $2,982.
Date of approval:[a]
Date of beginning work: July 18, 1903.
Date of expiration: December 31, 1903.

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## COMMERCIAL STATISTICS.

*Traffic through United States Locks Nos. 8 and 9 for the fiscal year 1904.*

| | | |
|---|---|---|
| Lock No. 8: | | |
| Freight | tons[b] | 75,794 |
| Passengers | number | 23,938 |
| Lock No. 9: | | |
| Freight | tons[b] | 61,462 |
| Passengers | number | 20,827 |

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## REPORT OF MR. J. L. CALLARD, ASSISTANT ENGINEER.

*Lock and Dam No. 10.*—Under their contract Baker & Judson completed the construction of the upper and lower guide cribs, the upper and lower guard cribs, the fenders for recesses for the intermediate gate, and a section of dam about 133 feet in length. The cribs were completed in November, 1901. The construction of the section of dam and the fenders for the recesses was commenced and completed during the present fiscal year.

The following quantities represent the materials furnished and the work accomplished:

| | | During fiscal year. | Prior to July 1, 1903. | Total. |
|---|---|---|---|---|
| Rock excavated | cubic yards | 31 | | 31 |
| Concrete laid | do | 1,751 | | 1,751 |
| Stone ballast placed | do | | 835 | 835 |
| Timber used for cribs and fenders | feet B. M. | 14,821 | 57,744 | 72,565 |
| Drift and screw bolts | pounds | 1,425 | 5,752 | 7,177 |

Under written agreement Baker & Judson built an upper guide wall. The wall (150 feet in length) is of concrete upon a pile foundation.

The following quantities represent the materials furnished and the work accomplished:

| | | During fiscal year. | Prior to July 1, 1903. | Total. |
|---|---|---|---|---|
| Earth excavated | cubic yards | 182 | | 182 |
| Earth filling | do | 182 | | 182 |
| Oak piles | linear feet | 704 | | 704 |
| Oak caps and floor | feet B. M | 8,127 | | 8,127 |
| Screw bolts | pounds | 505 | | 505 |
| Tie rods | do | 4,392 | | 4,392 |
| Wrought-iron pipe, 2-inch | linear feet | 120 | | 120 |
| Concrete | cubic yards | 306 | | 306 |

Under oral agreement with the Monongahela and Western Dredging Company about 600 cubic yards of filling were placed back of the upper guide wall.

Under written agreement Har [illegible] tone for riprapping the left bank of the river from the end of the upper guide wall to the upstream boundary of the lock grounds, about 935 linear feet. About one-half of the stone was delivered. The bank was graded and about one-fourth of the stone was placed by hire of labor.

Under oral agreement with Harry Wilson 303 cubic yards of earth filling were placed back of the upper guide wall.

*Lock and Dam No. 11.*—Baker & Judson, contractors.

The actual work of construction was commenced in August, 1901, and completed in November, 1903.

The following work was done during the fiscal year: About 203 linear feet of dam were built, the grading of the lock grounds was completed, the greater part of the stone paving was laid, and the protection to the right bank of the river in the vicinity of the dam was completed.

The following quantities represent the materials furnished and the work accomplished:

| | During fiscal year. | Prior to July 1, 1903. | Total. |
|---|---|---|---|
| Earth excavated .... ....cubic yards.. | 1,103 | 9,189 | 10,292 |
| Hardpan excavated ....do.... | ........ | 314 | 314 |
| Rock excavated ....do.... | 76 | 3,349 | 3,425 |
| Embankment placed ....do.... | 3,880 | 2,554 | 6,434 |
| Concrete laid ....do.... | 3,297 | 18,540 | 21,837 |
| Stone ballast placed ....do.... | 354 | 1,002 | 1,356 |
| Stone drain laid ....do.... | ........ | 1,085 | 1,085 |
| Stone paving laid ....square yards.. | 939 | 450 | 1,389 |
| Timber used for crib and fenders....feet B. M.. | ........ | 73,578 | 73,578 |
| Timber used for gates, quoins, etc....do.... | 15,659 | 40,832 | 56,491 |
| Drift and screw bolts ....pounds.. | 1,864 | 6,255 | 8,119 |
| Iron for gates....do.... | ........ | 46,194 | 46,194 |
| Iron for gate-maneuvering gear....do.... | ........ | 4,783 | 4,783 |

The construction of the dwelling was commenced in January, 1903, and completed in December, 1903. Thomas J. Williams, contractor.

Under oral agreement with Braddock Hall 197 cubic yards of earth were excavated for cellar for dwelling No. 1. The excavated material was placed back of the upper guide wall.

*Lock and Dam No. 12.*—The T. A. Gillespie Company, contractors.

The actual work of construction was commenced in June, 1901, and completed in March, 1904.

The following work was done during the fiscal year: The lower lock gate was assembled and placed in position and the sills and hollow quoins for same were placed. One hundred and four linear feet of dam and 75 linear feet of the upper guide wall were built. Grading the lock grounds was completed. The fenders for recesses for the intermediate gate were built and the protection to the right bank of the river in the vicinity of the dam was completed.

The following quantities represent the materials furnished and the work accomplished:

| | During fiscal year. | Prior to July 1, 1903. | Total. |
|---|---|---|---|
| Earth excavated ....cubic yards.. | 3,720 | 5,508 | 9,228 |
| Hardpan excavated ....do.... | ........ | 3,553 | 3,553 |
| Rock excavated ....do.... | 118 | 4,685 | 4,803 |
| Embankment placed ....do.... | 3,387 | 4,106 | 7,493 |
| Concrete laid ....do.... | 1,167 | 16,423 | 17,590 |
| Stone ballast placed ....do.... | 163 | 798 | 961 |
| Stone drain laid ....do.... | ........ | 749 | 749 |
| Stone paving laid ....square yards.. | 159 | 1,237 | 1,396 |
| Timber used for cribs and fenders ....feet B. M.. | 18,167 | 47,516 | 65,683 |
| Timber used for gates, quoins, etc....do.... | 35,372 | 21,653 | 57,025 |
| Drift and screw bolts ....pounds.. | 4,512 | 5,158 | 9,670 |
| Iron for gates....do.... | ........ | 46,194 | 46,194 |
| Iron for gate-maneuvering gear ....do.... | ........ | 4,811 | 4,811 |

The construction of the dwelling was commenced in July, 1903, and completed in [illegible] Thomas J. Williams, contractor.

[illegible]ds were cleared of underbrush and inclosed with a wire fence. A [illegible] No. 1 was excavated. Sites for storehouse, blacksmith shop, and coal house were graded and excavations for the foundation walls for the same and for the office building were made. About 125 linear feet of the left bank of the river next below the lock were graded and riprapped. This work was done by purchase of materials and hire of labor.

*Lock and Dam No. 13.*—The T. A. Gillespie Company, contractors.

The actual work of construction was commenced in June, 1901, and completed in March, 1904.

The following work was done during the fiscal year: Grading the lock grounds was completed. The upper lock gate was placed in position. Timber for the lower gate was framed. Framing of the sills and hollow quoins was completed. The sills and quoins were placed and the gate was assembled and placed in position. The stone paving was laid and the grading of the lock grounds and protection to the right bank of river in the vicinity of the dam were completed.

The following quantities represent the materials furnished and the work accomplished:

| | During fiscal year. | Prior to July 1, 1903. | Total. |
|---|---|---|---|
| Earth excavated ........ cubic yards.. | 1,091 | 6,224 | 7,315 |
| Hardpan excavated ........ do.... | 70 | 608 | 678 |
| Rock excavated ........ do.... | .......... | 3,013 | 3,013 |
| Embankment placed ........ do.... | 1,000 | 5,671 | 6,671 |
| Concrete laid ........ do.... | 51 | 15,235 | 15,286 |
| Stone ballast placed ........ do.... | .......... | 1,020 | 1,020 |
| Stone drain laid ........ do.... | .......... | 878 | 878 |
| Stone paving laid ........ square yards.. | 1,549 | 507 | 2,056 |
| Timber used for crib and fenders ........ feet B. M.. | 18,167 | 54,563 | 72,730 |
| Timber used for gates, quoins, etc ........ do.... | 56,895 | .......... | 56,895 |
| Drift and screw bolts ........ pounds.. | 6,460 | 4,748 | 11,208 |
| Iron for gates ........ do.... | .......... | 46,205 | 46,205 |
| Iron for gate-maneuvering gear ........ do.... | .......... | 4,809 | 4,809 |

The construction of the dwelling was commenced in August, 1903, and completed in December, 1903. Thomas J. Williams, contractor.

A cellar for dwelling No. 1 was excavated and a site for storehouse, blacksmith shop, and coal house was graded, and excavations for foundation walls for same and for the office building were made. This work was done by hire of labor.

*Lock and Dam No. 14.*—The T. A. Gillespie Company, contractors.

Actual construction was commenced in September, 1902, and is now practically completed.

The whole of the lock and dam was constructed during the fiscal year except the following, which was done prior to July 1, 1903, viz: About three-fourths of the excavation for foundation of the lock walls; about three-fourths of the grading of the lock grounds; two sections of lock wall, aggregating 204 feet in length; the upper guide wall, and a section of dam 60 feet in length.

The following quantities represent the materials furnished and the work accomplished:

| | During fiscal year. | Prior to July 1. 1903. | Total to date. |
|---|---|---|---|
| Earth excavated ........ cubic yards.. | 6,970 | 4,395 | 11,365 |
| Hardpan excavated ........ do.... | 213 | 465 | 678 |
| Rock excavated ........ do.... | 1,687 | 1,170 | 2,857 |
| Embankment placed ........ do.... | 3,100 | 1,040 | 4,140 |
| Concrete laid ........ do.... | 13,999 | 4,369 | 18,368 |
| Stone ballast placed ........ do.... | 656 | .......... | 656 |
| Stone drain laid ........ do.... | 31 | 80 | 111 |
| Stone paving laid ........ square yards.. | 1,525 | .......... | 1,525 |
| Timber used for fenders ........ feet B. M.. | 18,899 | .......... | 18,899 |
| Timber used for gates, quoins, etc ........ do.... | 57,025 | .......... | 57,025 |
| Drift and screw bolts ........ pounds.. | 6,567 | .......... | 6,567 |
| Iron for gates ........ do.... | 46,182 | .......... | 46,182 |
| Iron for gate-maneuvering gear ........ do.... | 4,808 | .......... | 4,808 |

The construction of the dwelling was commenced in August, 1903, and completed in March, 1904; Kammerer & Kern, contractors.

*Lock and Dam No. 15.*—The T. A. Gillespie Company, contractors.

The actual work of construction was commenced ir September, 1901, and completed in May, 1904.

The following work was done during the fiscal year: Grading the lock grounds was completed. Framing the timber for the lock gates was completed. The gates were assembled and placed in position. The sills and the hollow quoins were placed. The stone paving was laid, and the upper guide wall and 390 linear feet of dam were built.

The following quantities represent the materials furnished and the work accomplished:

| | During fiscal year. | Prior to July 1, 1903. | Total. |
|---|---|---|---|
| Earth excavated ........ cubic yards.. | 1,844 | 1,985 | 3,829 |
| Hardpan excavated ........ do.... | 334 | .......... | 334 |
| Rock excavated ........ do.... | 585 | 6,354 | 6,939 |
| Embankment placed ........ do.... | 1,930 | 5,624 | 7,554 |
| Concrete laid ........ do.... | 4,738 | 9,351 | 14,089 |
| Stone ballast placed ........ do.... | 249 | 745 | 994 |
| Stone drain laid ........ do.... | 20 | 918 | 938 |
| Stone paving laid ........ square yards.. | 1,528 | .......... | 1,528 |
| Timber used for cribs and fenders ........ feet B. M.. | 19,430 | 51,838 | 71,268 |
| Timber used for gates, quoins, etc ........ do.... | 57,018 | .......... | 57,018 |
| Drift and screw bolts ........ pounds.. | 4,726 | 3,850 | 8,576 |
| Iron for gates ........ do.... | .......... | 46,182 | 46,182 |
| Iron for gate-maneuvering gear ........ do.... | .......... | 4,808 | 4,808 |

The construction of the dwelling was commenced in April, 1903, and completed in February, 1904. Thomas J. Williams, contractor.

Under oral agreement with E. F. Hoult, 157 cubic yards of earth were excavated for cellar for dwelling No. 1.

## E E 2.

## IMPROVEMENT OF MONONGAHELA RIVER, PENNSYLVANIA.

*Locks 3, 6, and floating plant.*—The snagging steamer let to T. M. Rees, Pittsburg, Pa., in September, 1902, was completed and accepted during September, 1903. The new boat was named the *General Theodore Schwan*, and was placed in service. The dredge boat and scows built under contract were completed and accepted in August.

*Rebuilding Lock No. 2.*—The deed for the property purchased for the lock site below the mouth of Turtle Creek from the Carnegie Steel Company was approved and returned to this office in February. The amount agreed upon, viz, $30,000, for the lock site was paid to the Steel Company in March. Immediately following the decline of the river to a moderate stage in March, work with hired labor was started upon the construction of a temporary water intake for the supply of the eleven blast furnaces of the Carnegie Steel Works. This work was rendered necessary by reason of the fact that the cofferdam inclosing the proposed locks would include the mouths of two of the most important intakes through which from 50,000,000 to 70,000,000 gallons of water are daily taken from the river for cooling purposes about the furnaces. The excavation for the new intake was about 250 feet long and was taken out between pile rows about 14 feet apart to the depth of about 15 feet, 7 feet of which was below pool level. About half of the length of the conduit was made permanent with concrete work, affording an opening 5½ feet wide, 9 feet high below the spring line of the arch. Much trouble was experienced from high water and percolation from the river, but on the last day of June the old intakes were closed and water was admitted through the new conduit without for a nt interfering with the water supply of the steel works.

Bids for the construction of the new lock with two chambers, each 360 by 56 feet available length, were opened April 7. The Dravo Construction Company, of Pittsburg, Pa., were the lowest bidders, and the contract was awarded to them. By the end of June the contractors had nearly completed the cofferdam for the lock construction. The length of the dam being 655 feet, with arms to the shore, at the upper end 254 feet, and at the lower end 294 feet long. During May and June about 25,000 cubic yards of material had been dredged for the pile-work foundations. It is thought that the cofferdam can be unwatered about the middle of July, and the work of pile driving started immediately thereafter.

Plans for the abutment of the dam on the left bank of the river were completed in May and approved by the Department in June. The abutment will rest against an almost vertical slag bank 36 feet high, which extends along the United States harbor line in this vicinity for a half mile above and a greater distance below the dam. Work was commenced in June with hired labor cutting out spaces in the slag bank for two core walls and in excavating down to pool level along the front of the slag wall, in preparation for driving two rows of piles upon which to rest the concrete shore wall, 200 feet long, below the dam.

*Money statements.*

CONSOLIDATED.

| | |
|---|---|
| July 1, 1903, balance unexpended | $703,210.12 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 101,875.89 |
| July 1, 1904, balance unexpended | 601,334.23 |
| July 1, 1904, outstanding liabilities | 14,518.28 |
| July 1, 1904, balance available | 586,815.95 |
| July 1, 1904, amount covered by uncompleted contracts | 346,385.00 |

LOCKS 3, 6, ETC.

| | |
|---|---|
| July 1, 1903, balance unexpended | $53,868.10 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 46,951.72 |
| July 1, 1904, balance unexpended | 6,916.38 |
| July 1, 1904, outstanding liabilities | 4,153.00 |
| July 1, 1904, balance available | 2,763.38 |

REBUILDING LOCK NO. 2.

| | |
|---|---|
| July 1, 1903, balance unexpended | $649,342.02 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 54,924.17 |
| July 1, 1904, balance unexpended | 594,417.85 |
| July 1, 1904, outstanding liabilities | 10,365.28 |
| July 1, 1904, balance available | 584,052.57 |
| July 1, 1904, amount covered by uncompleted contracts | 346,385.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897. | 7,850.00 |

### APPROPRIATIONS.

| | |
|---|---|
| August 11, 1888, costs of condemnation, Lock and Dam No. 7, Monongahela River, Pennsylvania | [a]$5,000.00 |
| September 19, 1890, costs of condemnation, Lock and Dam No. 6, Monongahela River, Pennsylvania | [b]5,000.00 |
| August 11, 1888, purchase of Upper Lock and Dam No. 7, Monongahela River | [c]161,733.13 |
| September 19, 1890, purchase of Upper Lock and Dam No. 6, Monongahela River | [b]162,000.00 |
| June 3, 1896, costs of condemnation, property of Monongahela Navigation Company | [d]5,000.00 |
| June 3, 1896, award for property of Monongahela Navigation Company | 3,761,615.46 |
| March 3, 1899, improving Locks 3 and 6, and for floating plant | 50,000.00 |
| June 6, 1900, completing improvement at Locks 3 and 6, and for floating plant | 135,556.00 |
| June 13, 1902, rebuilding Lock and Dam 2 | 200,000.00 |
| March 3, 1903, rebuilding Lock and Dam 2 | 455,961.00 |
| Total | 4,941,865.59 |
| Amount carried to surplus fund | 331,274.71 |
| | 4,610,590.88 |

### ABSTRACT OF CONTRACTS IN FORCE.

*Building a dredge hull and furnishing and installing machinery therein.*

Contractor: M. A. Sweeney Shipyard and Foundry Company, Jeffersonville, Ind.
Rate: $19,740.
Date of approval: May 22, 1902.
Date of beginning work: June 3, 1902.
Date of expiration: December 26, 1902 (extended for a reasonable period).

*Building a steel single-hull repair steamer, with snagging appliances.*

Contractor: Thomas M. Rees, Pittsburg, Pa.
Rate: $51,800.
Date of approval: September 29, 1902.
Date of beginning work: October 10, 1902.
Date of expiration: December 1, 1903 (extended for a reasonable period).

*Building a lock with two chambers, two guide walls, and a guard wall, below Turtle Creek, opposite the Edgar Thomson Furnaces, Monongahela River.*

Contractor: The Dravo Contracting Company, Pittsburg, Pa.
Rates: Earth excavation, 60 cents per cubic yard; hardpan excavation, 75 cents per cubic yard; rock excavation, $1 per cubic yard; piles, $6 each; piles, sheet, $55 per M feet B. M.; caps, flooring, and wales (oak), $54 per M feet B. M.; grillage (hemlock), $41.50 per M feet B. M.; crib timber (hemlock), $43 per M feet B. M.; stone ballast, $2.50 per cubic yard; concrete (lock, guide, and guard walls), $5.50 per cubic yard; concrete (floor of lock), $5.50 per cubic yard; I beams (steel), 4 cents per pound; iron for bolts, shoes, etc., 4 cents per pound.
Date of approval: May 16, 1904.
Date of beginning work: June 7, 1904.
Date of expiration: June 30, 1905.

### COMMERCIAL STATISTICS.

Commercial statistics for Monongahela River, Pennsylvania, are attached to report for operating and care of locks and dams, Monongahela River, West Virginia and Pennsylvania.

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[a] Partly applied; $98.64 to surplus fund.
[b] To surplus fund.
[c] Partly applied; $161,333.13 to surplus fund.
[d] Partly applied; $2,842.94 to surplus fund.

## E E 3.

## OPERATING AND CARE OF LOCKS AND DAMS, MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA.

The winter was marked by long-continued cold weather and hard freezing of the rivers. The coal trade from the sixth pool downward was seriously inconvenienced by ice for a number of days, but there was no actual shortage in the supply of river coal at Pittsburg. A serious disaster, which is noted below, occurred to one of the locks at Dam No. 4.

The principal repairs and improvements were as follows:

*Lock and Dam No. 1, Pittsburg.*—A new arc-light plant was installed. A building 16 by 30 feet was constructed for the storing of oils and paints. A new slate roof was placed on the lockmaster's dwelling. The break-up of the ice in January considerably damaged the office, the depth of water on the walls at the time being 9 feet. The basement of the dwelling was filled in several feet and concreted in order to bring it above the reach of ordinary floods. A new steel hood was placed on one of the gates of the large lock and the anchorage taken up and relaid more securely. A distilling apparatus, capacity 8 gallons per hour, was erected at the lock to furnish potable water for the lockmen and crews of the Government boats of the Pittsburg district.

*Lock and Dam No. 2, Port Perry.*—In August a serious leak developed through the floor of the large lock. The void made by erosion beneath the floor, which was 50 feet long, 25 feet wide, and 2 feet depth was filled with grout. About 1,500 feet B. M. oak plank were used in replacing worn-out protection plank on the lock gates. The small electric-light plant formerly used at Lock 1 was repaired and placed in service at this lock, furnishing two arc and a number of incandescent lights. In June the guide crib above the lock, 180 feet long, fell down, temporarily interfering with the use of the large lock. Arrangements were in progress at the end of the month to replace it with a line of piles sheeted with heavy oak plank. The accident to the old crib was thought to be due to the filling out of the bank by the Pittsburg and Lake Erie Railroad Company and to leakage from the railroad company's water tower or standpipe in the vicinity. The turbine on the land wall was repaired. The boiler house on the middle wall was lengthened several feet and the new boiler covered with dolomite.

*Lock and Dam No. 3, above Elizabeth.*—The capstans on the middle wall were extensively repaired and the office and porch of the dwelling painted. About 1,500 feet B. M. oak plank were expended in repairs to lock gates. During October and November considerable time and labor was expended in extinguishing a fire which developed in the filling behind the lower guide crib, in which filling there was a considerable proportion of coal waste mixed with the gravel which had been dredged from the river several years ago to the amount of 10,000 cubic yards and deposited behind the crib. In October a serious leak developed beneath the river wall of the small lock, which undermined the chamber floor to the depth of 4 feet at one point. It was discovered just in time to prevent the collapse of the lock wall, the void being filled with grout, 60 barrels of cement and 250 bushels of sand being used on this work.

*Lock and Dam No. 4, below Charleroi.*—In September work was started upon the lengthening of the dam 100 feet and constructing a new sloped concrete abutment. The work was completed about the middle of December, excepting the filling out of the bank and slope revetment. Included in the work was a submerged crib below the dam 18 by 60 feet and a low concrete shore protection wall 150 feet long resting on a double row of piles. The foundations for the extension of the dam were dredged to 16 feet below pool level, at which depth hard gravel was found. The dam was raised 18 inches in height entirely across the river, requiring about 62,000 feet B. M. timber and plank, in order to afford increased depth at the upper end of Pool No. 4.

On March 10 the passenger steamer *Edgar Cherry*, on her way up the river, in attempting to pass through the small lock, owing to some mistake in the signal bells, crashed into the upper gate with such force as to knock down one of the leaves. Instantly the steamer was swept out of the lock by the inrush of water from the upper pool. One of the lower gates, becoming jammed against the *Cherry*, started such leaks that the steamer sank in 15 feet of water below the lock. No lives were lost. Before the water rushing through the lock could be shut off much of the timber floor in the chamber was washed out and the walls so much undermined that they threatened to collapse. The extent of the damage is not yet fully known, though the work of repair has made such progress that it is thought the lock can be pumped out in July and the bottom concreted. To accommodate the river traffic through the remaining lock, which is fortunately the larger one, steam engines were placed at each end of the walls to assist in maneuvering the gates, the damage to the small lock having interferred with the water power previously used.

The grounds about the lock were raised several feet. The new dwelling and office commenced last year were completed. Several of the lock gates were thrown and repaired, and work was started on the raising of the guide crib below the lock about 4 feet additional height.

*Lock and Dam No. 5, above Brownsville.*—About 870 feet B. M. oak plank were expended in repairs to lock gates. Only ordinary repairs were necessary to the lock walls, operating machinery, dam, buildings, etc. Near the end of June the dam was raised permanently 10 inches in height, and 24-inch flashboards were added to this extra height for the benefit of the coal trade originating in or passing through Pool No. 5.

*Lock and Dam No. 6, Rice's Landing.*—During the fall and winter nearly 3,000 cubic yards of hard limestone rock were removed from the lower approach to the lock by blasting, in order to afford a depth equal to that afforded on the new miter sill of the lock. The removal of this rock was demanded in the interest of the rapidly increasing coal trade from the sixth pool. In connection with this traffic it was also found necessary to remove about 4,000 cubic yards of gravel and bowlders from Rush Run bar, about a half mile below Lock No. 5. Only minor repairs were necessary about the lock. About 70 feet of the lower slope of the dam was seriously injured by the ice following a break-up in the river in January. It became necessary to effect immediate temporary repairs, which work was done while several feet of water was passing over the dam.

*Lock and Dam No. 7, below Greensboro.*—A second dwelling of six rooms above basement was constructed under contract. A room was fitted up in basement for lock office. The old dwelling and repair shop were painted, and the interior walls of old dwelling repapered. Eighty square yards of cement walk were made between and about the dwellings, and concrete steps were constructed on the terrace slope.

Rebuilding the 240-foot guard crib above the lock was completed.

Two hand capstans were placed and rigged to facilitate the handling of craft in the lock entrances.

*Lock and Dam No. 8, mouth of Dunkard Creek.*—Under contract a new lock office was constructed and an addition to the lockman's dwelling completed. Several rooms were papered and a new floor laid in the kitchen of the lock master's dwelling. Old dilapidated outbuildings were razed and the grounds graded and seeded. A new coal house was built.

A guide crib was constructed above the lock 224 feet long, with an additional 86-foot return to the river bank. The 100-foot guard crib above the lock was rebuilt. A few empty cribs of the dam were filled with stone. A new gear wheel was placed for repair of operating machinery.

Back of the upper wing wall concrete steps were constructed on the terrace slope, continuing with a cement walk to the new office.

Minor repairs to the lock gates were made.

*Lock and Dam No. 9, Hoard, W. Va.*—The new office and the addition to dwelling were completed by contract. Several rooms of dwelling were repapered.

Sunken portions of the pavement of the lock terreplein, 336 square yards in all, were taken up, refilled with broken stone, and pavement relaid.

Bumping plank were placed on the upper lock gates and oak-plank fenders on top of lock walls at chamber face edge. Work was commenced pointing masonry of lock walls.

*Locks and Dams Nos. 10 to 15, inclusive.*—The six new locks, extending slack water from Morgantown to Fairmont, W. Va., were opened to navigation in January, but owing to the hard freezing of the river it was not until March 18 that the small steamer *Gazette* reached Fairmont, being the first steamer from below to pass through Lock No. 15. The grounds about the several locks were cleared of rubbish. At No. 10, 550 cubic yards of material, dredged from the lock approach, were used to fill behind the upper guard wall. At No. 12, 150 rods of fencing were erected.

*Boat yard and shop, Lock No. 4.*—The hull for the repair steamer *Slackwater* was provided with new boilers at Pittsburg in July and sent to the boat yard where the derrick and other appurtenances from the old *Slackwater* were transferred to the new boat. The snag and repair steamer *Gen. Theodore Schwan* was completed under contract and accepted during the latter part of September. The steamer's length over all is 159 feet; beam over all, 31 feet 4 inches; depth of hold, 5 feet. Engines, 15 inches by 6 feet. Tonnage, 154. The hull is of steel. The boat is equipped with steel shears (Phœnix columns); capacity, 90 tons; also with a steel wrecking hook, scraper, etc., and has steam steering gear. A dredge boat and two 100-ton scows were completed uuder contract and accepted August 29, going immediately into service. One 150-ton stone flat was built at the yard, and three new lock gates for the small lock at No. 4, damaged by the steamer *Edgar Cherry* March 10. A 1,500-pound steam hammer was erected in the forge building. The boilers of the old *Slackwater* were repaired and placed in the new boiler house to operate the sawmill and shop. The machine and carpenter shops were kept busy most of the time upon miscellaneous repair work.

*Snagging, etc.*—There were removed from the channel in the various pools the following snags, trees, and stumps: Pool 1, 3; pool 2, 2; pool 3, 174; pool 4, 222; pool 5, 6; pool 6, 13; pool 7, 3; pool 8, 2; pool 10, 1; pool 11, 2; pool 13, 3. The wreck of a dredge scow was removed from the fifth pool by the snagging steamer *General Schwan*. Three sunken coal flats were removed from the lower approach of Lock No. 4 by the United States dredge boat.

*Harbor lines, McKeesport to Elizabeth.*—Harbor lines were extended along both banks of the river from McKeesport, mouth of the Youghiogheny River, to Elizabeth, a distance of about 7 miles. The work was plotted on four sheets, Nos. 29 to 32, and are now awaiting the final approval of the Secretary of War.

*Dredging during fiscal year 1904.*

| Date. | Pool. | Location. | General description of work. | Cubic. yards. |
|---|---|---|---|---|
| 1903. | | | | |
| July | 9 | Lock No. 8, upper approach | Foundations for guide crib, gravel. | 5,900 |
| August | 1 | Bar, mouth of Turtle Creek | Gravel, sand, coal waste, etc | 900 |
| September | 3 | Extension of Dam No. 4 | Gravel, clay, and sand | 17,500 |
| October | 3 | do | do | 20,000 |
| Do | 3 | Upper approach, Lock No. 3 | Gravel and sand | 4,000 |
| Do | 5 | Lower approach, Lock No. 6 | Blasted rock from channel | 500 |
| November | 5 | Upper approach, Lock No. 5 | Clay from land slip | 4,200 |
| December | 5 | do | do | 350 |
| Do | 5 | Lower approach, Lock No. 6 | Blasted rock from channel | 1,175 |
| 1904. | | | | |
| January | 5 | do | do | 950 |
| Do | 5 | Rush Run bar | Gravel and bowlders | 8,100 |
| February | 5 | Lower approach, Lock No. 6 | Blasted rock from channel | 1,050 |
| Do | 5 | Rush Run bar | Gravel and bowlders | 2,900 |
| March | 5 | do | do | 145 |
| May | 6 | Lower approach, Lock No. 7 | Gravel and sand | 450 |
| Do | 1 | Bar, mouth of Turtle Creek | Gravel, sand, and coal waste | 7,000 |
| | | Total | | 70,120 |

About half of the dredging was done by the new United States dredge boat which was placed in commission near the end of September.

*Monthly lockages of vessels at different dams.*

| Dam. | 1903. | | | | | | 1904. | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. | |
| 1 | 2,341 | 1,602 | 1,321 | 1,651 | 1,387 | 957 | 712 | 928 | 1,676 | 2,066 | 2,282 | 1,687 | 18,610 |
| 2 | 2,207 | 1,835 | 1,678 | 1,619 | 1,407 | 885 | 467 | 854 | 1,977 | 2,265 | 2,227 | 1,811 | 19,232 |
| 3 | 1,877 | 1,497 | 1,339 | 1,487 | 1,352 | 890 | 269 | 614 | 1,698 | 1,793 | 1,576 | 1,398 | 15,790 |
| 4 | 1,598 | 1,465 | 1,385 | 1,474 | 1,299 | 807 | 232 | 565 | 1,466 | 1,456 | 1,292 | 1,303 | 14,342 |
| 5 | 609 | 707 | 761 | 675 | 819 | 407 | 82 | 129 | 567 | 788 | 681 | 615 | 6,840 |
| 6 | 263 | 323 | 446 | 299 | 209 | 102 | 81 | 23 | 238 | 310 | 335 | 349 | 2,978 |
| 7 | 168 | 183 | 195 | 209 | 137 | 46 | 4 | 0 | 82 | 139 | 170 | 140 | 1,473 |
| 8 | 178 | 241 | 237 | 235 | 157 | 47 | 2 | 0 | 117 | 166 | 215 | 174 | 1,769 |
| 9 | 137 | 161 | 153 | 162 | 119 | 46 | 2 | 0 | 72 | 112 | 176 | 129 | 1,269 |
| 10 | | | | | | | | | 21 | 83 | 126 | 103 | 333 |
| 11 | | | | | | | | | 8 | 76 | 127 | 114 | 325 |
| 12 | | | | | | | | | 5 | 80 | 100 | 83 | 268 |
| 13 | | | | | | | | | 2 | 81 | 100 | 79 | 262 |
| 14 | | | | | | | | | 9 | 75 | 103 | 97 | 284 |
| 15 | | | | | | | | | 8 | 71 | 334 | 194 | 607 |
| Total | 9,378 | 8,014 | 7,515 | 7,811 | 6,886 | 4,187 | 1,851 | 3,113 | 7,946 | 9,561 | 9,844 | 8,276 | 84,382 |

**NOTE.—Navigation through Locks 10–15, inclusive, did not begin until close of winter season, in March 1904.**

The locks were temporarily closed to navigation for times and reasons as follows:

| Lock. | Repairs. | Floods. | Ice. | Total time. | Number of times. |
|---|---|---|---|---|---|
| No. 1: | *d. h. m.* | *d. h. m.* | *d. h. m.* | *d. h. m.* | |
| Large | 2 23 30 | 6 17 45 | 0 0 0 | 9 17 15 | 6 |
| Small | 6 9 25 | 6 17 45 | 0 0 0 | 13 3 10 | 6 |
| No. 2: | | | | | |
| Large | 19 19 0 | 3 0 30 | 3 0 0 | 25 19 30 | 6 |
| Small | 0 21 0 | 3 0 30 | 3 0 0 | 6 21 30 | 5 |
| No. 3: | | | | | |
| Large | 1 6 0 | 1 0 0 | 20 0 0 | 22 6 0 | 6 |
| Small | 1 6 0 | 1 0 0 | 20 0 0 | 22 6 0 | 6 |
| No. 4: | | | | | |
| Large | 1 3 0 | 0 8 45 | 18 0 0 | 19 11 45 | 5 |
| Small | 0 0 0 | 7 21 30 | 18 0 0 | 25 21 30 | 8 |
| No. 5 | 0 0 0 | 0 0 0 | 32 0 0 | 32 0 0 | 2 |
| No. 6 | 0 0 0 | 0 0 0 | 41 0 0 | 41 0 0 | 2 |
| No. 7 | 0 0 0 | 0 0 0 | 62 0 0 | 62 0 0 | 3 |
| No. 8 | 0 0 0 | 0 0 0 | 63 0 0 | 63 0 0 | 3 |
| No. 9 | 0 0 0 | 0 0 0 | 67 0 0 | 67 0 0 | 8 |

Locks Nos. 10 to 15, inclusive, were opened to navigation in January, but on account of ice no attempt was made by steamers to reach Pool No. 15 until after March 1.

ALLOTMENTS OF FUNDS.

| | |
|---|---|
| August 15, 1884 | $1,000.00 |
| September 1, 1884 | 4,000.00 |
| November 3, 1884 | 4,500.00 |
| December 20, 1884 | 500.00 |
| June 1, 1885 | 100.00 |
| July 22, 1885 | 1,000.00 |
| July 10, 1886 | 1,200.00 |
| March 1, 1887 | 1,100.00 |
| July 1, 1887 | 11,000.00 |
| July 11, 1888 | 6,270.00 |
| October 27, 1888 | 3,000.00 |
| July 17, 1889 | 1,480.00 |
| October 7, 1889 | 1,500.00 |
| November 6, 1889 | 1,200.00 |
| July 24, 1890 | 12,300.00 |
| July 8, 1891 | 24,250.00 |
| July 21, 1892 | 34,017.86 |
| July 21, 1893 | $23,574.72 |
| July 23, 1894 | 25,664.00 |
| July 12, 1895 | 20,372.40 |
| July 28, 1896 | 19,232.84 |
| July 15, 1897 | [a] 13,070.87 |
| August 2, 1897 | [b] 119,734.49 |
| October 8, 1897 | 125.00 |
| September 1, 1898 | [c] 197,627.93 |
| August 14, 1899 | 169,838.00 |
| September 7, 1900 | 175,474.96 |
| August 5, 1901 | 159,266.46 |
| July 26, 1902 | 237,963.86 |
| August 4, 1903 | 200,949.31 |
| August 10, 1903 | 21,050.00 |
| November 18, 1903 | [d] 21,500.00 |
| Total | 1,513,862.70 |

*Classified statement of expenditures for operating and care of Monongahela River Locks and Dams Nos. 1 to 15, inclusive, during the fiscal year ending June 30, 1904.*

| Item. | Amount. |
|---|---|
| Salaries and wages | $161,000.00 |
| Miscellaneous supplies and services | 3,445.82 |
| Dam, lock, and boatyard supplies | 37,268.37 |
| Repair plant | 4,679.61 |
| Rebuilding, dredging, and removing obstructions | 85,755.33 |
| Total | 292,149.13 |

[a] Locks 8 and 9. [b] Locks 1 to 7, inclusive. [c] Locks 1 to 9, inclusive. [d] Locks 10 to 15.

### ABSTRACT OF CONTRACTS IN FORCE.

*Building an office building and a lockmaster's dwelling at Lock No. 4, Monongahela River.*

Contractor: Charleroi Lumber Company, Charleroi, Pa.
Rates:
Office, $1,170.
Dwelling, $2,950.
Date of approval:[a]
Date of beginning work: December 18, 1902.
Dates of expiration:
Office, February 1, 1903.
Dwelling, March 1, 1903.

*Building an office at each of Locks Nos. 8 and 9, Monongahela River, and additions to dwelling at Lock No. 9, Monongahela River.*

Contractors: Darrah Brothers, Morgantown, W. Va.
Rates:
Office at Lock No. 8, $800.
Office at Lock No. 9, $800.
Additions to dwelling at Lock No. 9, $987.
Date of approval:[a]
Date of beginning work: March 10, 1903.
Date of expiration: June 30, 1903 (extended for a reasonable period).

*Building a dwelling at Lock No. 7, Monongahela River, and additions to dwelling at Lock No. 8, Monongahela River.*

Contractor: George B. Darrah, Morgantown, W. Va.
Rates:
Dwelling at Lock No. 7, $2,500.
Additions to dwelling at Lock No. 8, $1,000.
Date of approval:[a]
Date of beginning work: March 17, 1903.
Date of expiration: July 31, 1903 (extended for a reasonable period).

*Building two marine steel boilers and placing same on new U. S. repair boat Slackwater.*

Contractor: James Rees & Sons Co., Pittsburg, Pa.
Rate: $2,650.
Date of approval:[a]
Date of beginning work: March 15, 1903.
Date of expiration: April 1, 1903.

*Building and delivering in the harbor of Pittsburg, Pa., a steel lock gate and anchorage.*

Contractor: American Bridge Company of New York, New York, N. Y.
Rates: White oak, $60 per M feet B. M.; iron, steel, and bronze, 4½ cents per pound.
Date of approval: June 18, 1904.
Date of beginning work: July 8, 1904.
Date of expiration: November 1, 1904.

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[a] Emergency.

## COMMERCIAL STATISTICS.

*Lockages made and traffic passed at Monongahela River locks during year ending June 30, 1904.*

| At dams— | Lockages. | | Steamboats. | | Coal boats, barges, flats, and boat bottoms. | | Rafts. | |
|---|---|---|---|---|---|---|---|---|
| | Up. | Down. | Up. | Down. | Up. | Down. | Up. | Down. |
| | *Number.* | *Number.* | *Number.* | *Number.* | *Number.* | *Number.* | *No.* | *No.* |
| 1 | 9,429 | 9,181 | 6,755 | 6,750 | 14,211 | 14,269 | 212 | 12 |
| 2 | 9,775 | 9,457 | 5,881 | 5,866 | 16,636 | 16,813 | 171 | 20 |
| 3 | 7,972 | 7,818 | 4,752 | 4,751 | 18,403 | 18,519 | 30 | 65 |
| 4 | 7,162 | 7,180 | 4,190 | 4,218 | 15,092 | 15,265 | 11 | 67 |
| 5 | 3,285 | 3,555 | 2,664 | 2,656 | 2,482 | 2,454 | 5 | 79 |
| 6 | 1,447 | 1,531 | 1,092 | 1,087 | 901 | 933 | 6 | 69 |
| 7 | 702 | 771 | 569 | 568 | 374 | 384 | 7 | 74 |
| 8 | 859 | 910 | 669 | 667 | 388 | 414 | 14 | 101 |
| 9 | 621 | 648 | 518 | 514 | 306 | 314 | 6 | 35 |
| 10 | 165 | 168 | 136 | 136 | 34 | 28 | ...... | 4 |
| 11 | 160 | 165 | 121 | 119 | 26 | 20 | ...... | 4 |
| 12 | 131 | 137 | 118 | 118 | 18 | 14 | ...... | 23 |
| 13 | 130 | 132 | 118 | 116 | 17 | 13 | 1 | 2 |
| 14 | 136 | 148 | 112 | 113 | 21 | 25 | ...... | 3 |
| 15 | 306 | 301 | 249 | 247 | 74 | 77 | ...... | ........ |
| Aggregate | 42,280 | 42,102 | 27,944 | 27,926 | 68,983 | 69,542 | 463 | 558 |

| At dams— | Other craft. | | Coal. | | Coke. | | Rails, steel. | |
|---|---|---|---|---|---|---|---|---|
| | Up. | Down. | Up. | Down. | Up. | Down. | Up. | Down. |
| | *Number.* | *Number.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1 | 537 | 512 | 20,584 | 4,709,740 | ........ | 8,400 | 17 | 520 |
| 2 | 531 | 540 | 12,288 | 6,811,684 | ........ | 75 | 208 | ........ |
| 3 | 254 | 241 | 1,988 | 7,268,288 | ........ | ........ | 200 | ........ |
| 4 | 382 | 352 | 228 | 5,938,132 | ........ | ........ | 61 | 2 |
| 5 | 869 | 877 | 740 | 610,760 | ........ | ........ | 179 | ........ |
| 6 | 261 | 260 | 700 | 225,820 | ........ | ........ | 18 | ........ |
| 7 | 52 | 49 | 468 | 220 | ........ | ........ | ........ | ........ |
| 8 | 165 | 164 | 400 | 180 | ........ | ........ | ........ | 5 |
| 9 | 67 | 76 | 300 | 200 | ........ | ........ | ........ | ........ |
| 10 | 44 | 37 | 280 | 160 | ........ | ........ | ........ | ........ |
| 11 | 50 | 48 | 360 | 220 | ........ | ........ | ........ | ........ |
| 12 | 24 | 24 | 280 | 160 | ........ | ........ | ........ | ........ |
| 13 | 22 | 19 | 280 | 160 | ........ | ........ | ........ | ........ |
| 14 | 22 | 23 | 230 | 196 | ........ | ........ | ........ | ........ |
| 15 | 73 | 67 | 280 | 160 | ........ | ........ | ........ | ........ |
| Aggregate | 3,353 | 3,289 | 39,456 | 25,566,080 | ........ | 8,475 | 683 | 527 |

| At dams— | Other iron products. | | Sand. | | Gravel. | |
|---|---|---|---|---|---|---|
| | Up. | Down. | Up. | Down. | Up. | Down. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1 | 6,563 | 36,679 | 254,689 | 37,035 | 458,310 | 5,656 |
| 2 | 5,391 | 11,086 | 50,242 | 90,141 | 307,672 | 4,413 |
| 3 | 7,017 | 10,663 | 12,208 | 217,443 | 75,896 | 1,586 |
| 4 | 6,463 | 246 | 25,658 | 476 | 65,068 | 559 |
| 5 | 6,396 | 380 | 776 | 207 | 129,442 | ........ |
| 6 | 5,823 | 139 | 431 | 207 | 32,546 | ........ |
| 7 | 4,758 | 189 | 276 | 211 | 11,690 | ........ |
| 8 | 4,058 | 137 | 276 | 435 | 12,428 | ........ |
| 9 | 3,080 | 147 | 1,240 | 358 | 5,331 | ........ |
| 10 | ........ | 10 | 69 | ........ | ........ | ........ |
| 11 | 10 | 25 | 69 | ........ | ........ | ........ |
| 12 | 40 | 10 | 69 | ........ | ........ | ........ |
| 13 | 40 | 7 | 34 | ........ | ........ | ........ |
| 14 | 40 | 7 | ........ | ........ | ........ | ........ |
| 15 | ........ | ........ | ........ | ........ | ........ | ........ |
| **Aggregate** | **49,679** | **59,725** | **346,037** | **346,513** | **1,098,383** | **12,214** |

*Lockages made and traffic passed at Monongahela River locks*—Continued.

| At dams— | Stone. | | Brick. | | Timber. | |
|---|---|---|---|---|---|---|
| | Up. | Down. | Up. | Down. | Up. | Down. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1 | 3,936 | 3,176 | 360 | 2,382 | 34,955 | 3,794 |
| 2 | 695 | 4,152 | 9 | 3 | 24,870 | 2,473 |
| 3 | 1,667 | 4,150 | 21 | .......... | 6,269 | 11,754 |
| 4 | 1,706 | 6,422 | 1,320 | .......... | 2,999 | 24,550 |
| 5 | 24 | 10,482 | 395 | 188 | 974 | 13,272 |
| 6 | 53 | 6,042 | 66 | 246 | 1,102 | 14,011 |
| 7 | 109 | 5,062 | 20 | 1,883 | 1,046 | 10,731 |
| 8 | 223 | 1,597 | 8 | 2,769 | 1,189 | 9,086 |
| 9 | 4 | 765 | .......... | 2,865 | 376 | 15,044 |
| 10 | .......... | .......... | .......... | .......... | .......... | 433 |
| 11 | .......... | .......... | .......... | .......... | .......... | 323 |
| 12 | .......... | .......... | .......... | .......... | .......... | 303 |
| 13 | .......... | .......... | .......... | .......... | .......... | 303 |
| 14 | 147 | .......... | .......... | .......... | 6 | 57 |
| 15 | 200 | .......... | .......... | .......... | .......... | 11 |
| Aggregate | 8,764 | 41,848 | 2,199 | 10,336 | 73,786 | 106,145 |

| At dams— | Lumber. | | Laths. | | Posts. | |
|---|---|---|---|---|---|---|
| | Up. | Down. | Up. | Down. | Up. | Down. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1 | 28,373 | 2,345 | 322 | 2 | 23,965 | .......... |
| 2 | 21,542 | 1,726 | 299 | 2 | 32,315 | 28 |
| 3 | 14,211 | 2,988 | 165 | .......... | 23,195 | 475 |
| 4 | 3,624 | 2,221 | 23 | 1 | 12,105 | 825 |
| 5 | 1,981 | 8,815 | 107 | 8 | 480 | 12,665 |
| 6 | 1,021 | 9,018 | 52 | 4 | .......... | 15,572 |
| 7 | 184 | 10,124 | 6 | 1 | .......... | 23,135 |
| 8 | 620 | 8,830 | .......... | 8 | 25 | 14,165 |
| 9 | 62 | 9,197 | .......... | 7 | .......... | 11,205 |
| 10 | 8 | 416 | .......... | .......... | .......... | .......... |
| 11 | 12 | 470 | .......... | .......... | .......... | .......... |
| 12 | 1 | 228 | .......... | .......... | .......... | .......... |
| 13 | 38 | 7 | .......... | .......... | .......... | .......... |
| 14 | 2 | 8 | .......... | .......... | .......... | .......... |
| 15 | 11 | 50 | .......... | .......... | .......... | .......... |
| Aggregate | 71,690 | 56,438 | 974 | 33 | 92,085 | 78,070 |

| At dams— | Braces. | | Ties, railroad. | | Wood. | | General merchandise. | |
|---|---|---|---|---|---|---|---|---|
| | Up. | Down. | Up. | Down. | Up. | Down. | Up. | Down. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1 | 2,244 | .......... | 4,240 | 110 | .......... | 35 | 20,378 | 12,635 |
| 2 | 2,802 | 28 | 5,710 | 90 | .......... | 41 | 19,609 | 7,107 |
| 3 | 460 | 40 | 3,080 | 100 | .......... | 41 | 18,652 | 6,143 |
| 4 | 180 | 40 | 2,360 | 100 | 79 | 6 | 17,904 | 4,351 |
| 5 | .......... | 40 | .......... | 4,065 | .......... | 41 | 17,080 | 4,230 |
| 6 | .......... | 40 | .......... | 2,340 | .......... | 41 | 13,039 | 3,516 |
| 7 | .......... | 100 | .......... | 2,808 | 70 | 35 | 9,000 | 2,686 |
| 8 | .......... | 3,001 | .......... | 5,798 | 6 | 541 | 6,721 | 1,896 |
| 9 | .......... | 40 | .......... | 3,535 | .......... | 17 | 5,155 | 1,512 |
| 10 | .......... | .......... | .......... | 1,405 | .......... | .......... | 121 | 61 |
| 11 | .......... | .......... | .......... | .......... | .......... | .......... | 135 | 33 |
| 12 | .......... | .......... | .......... | .......... | .......... | .......... | 122 | 33 |
| 13 | .......... | .......... | .......... | .......... | .......... | .......... | 107 | 43 |
| 14 | .......... | .......... | .......... | .......... | .......... | .......... | 62 | 52 |
| 15 | .......... | .......... | .......... | .......... | .......... | .......... | 22 | 259 |
| Aggregate | 5,686 | 3,329 | 15,390 | 20,351 | 155 | 798 | 128,107 | 44,557 |

*Lockages made and traffic passed at Monongahela River locks*—Continued.

| At dams— | Farm, dairy, and orchard products. |  | Live stock, large. |  | Live stock, small. |  | Passengers. |  |
|---|---|---|---|---|---|---|---|---|
|  | Up. | Down. | Up. | Down. | Up. | Down. | Up. | Down. |
|  | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Number.* | *Number.* |
| 1 | 2,414 | 547 | 353 | 202 | 3 | 23 | 59,176 | 56,998 |
| 2 | 2,478 | 626 | 381 | 206 | 2 | 22 | 51,931 | 50,373 |
| 3 | 2,402 | 708 | 333 | 223 | 1 | 22 | 27,947 | 27,383 |
| 4 | 2,473 | 729 | 297 | 178 | ........ | 19 | 17,856 | 17,248 |
| 5 | 2,161 | 648 | 141 | 116 | 1 | 29 | 31,981 | 30,221 |
| 6 | 1,800 | 539 | 116 | 97 | 1 | 26 | 15,716 | 13,865 |
| 7 | 1,410 | 414 | 84 | 61 | 1 | 2 | 12,321 | 12,301 |
| 8 | 924 | 346 | 61 | 61 | ........ | ........ | 12,181 | 11,757 |
| 9 | 659 | 233 | 49 | 71 | 1 | 9 | 10,814 | 10,013 |
| 10 | ........ | ........ | ........ | 1 | ........ | ........ | 2,478 | 2,098 |
| 11 | ........ | ........ | ........ | 1 | ........ | ........ | 2,601 | 2,134 |
| 12 | ........ | ........ | ........ | ........ | ........ | ........ | 2,428 | 2,068 |
| 13 | ........ | ........ | ........ | ........ | ........ | ........ | 2,697 | 2,513 |
| 14 | ........ | ........ | ........ | ........ | ........ | ........ | 2,863 | 2,604 |
| 15 | 10 | ........ | ........ | ........ | ........ | ........ | 9,248 | 8,095 |
| Aggregate | 16,731 | 4,790 | 1,815 | 1,217 | 10 | 152 | 262,238 | 249,671 |

NOTE.—Navigation through Locks 10–15, inclusive, did not begin until close of winter season, in March, 1904.

*Total commerce of the river.*

| Fiscal year. | Products. | Passengers. |
|---|---|---|
|  | *Tons.*[a] |  |
| 1902 | 9,100,887 | 181,527 |
| 1903 | 11,369,814 | 101,457 |
| 1904 | 9,268,736 | 116,174 |

[a] 2,000 pounds.

The total commerce on the Monongahela River is obtained by summing up the maximum tonnage of the several kinds of freight passing any single dam. The coal item in this total is that passed down through Lock No. 3, plus that mined in the first and second pools.

## E E 4.

## IMPROVEMENT OF HARBOR AT PITTSBURG, PENNSYLVANIA.

A detailed description of the work done during the fiscal year ending June 30, 1904, will be found in the attached report of Assistant Engineer H. C. Gould.

*Money statement.*

|  |  |  |
|---|---|---|
| July 1, 1903, balance unexpended |  | $13,486.29 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 |  | 5,000.00 |
|  |  | 18,486.29 |
| June 30, 1904, amount expended during fiscal year: |  |  |
| For works of improvement | $3,486.29 |  |
| For maintenance of improvement | 6,970.08 |  |
|  |  | 10,456.37 |
| July 1, 1904, balance unexpended |  | 8,029.92 |
| July 1, 1904, outstanding liabilities |  | 326.83 |
| July 1, 1904, balance available |  | 7,703.09 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 |  | 10,000.00 |

bmitted in compliance with requirements of sundry civil act of June 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

| | |
|---|---|
| March 3, 1899 | $110,662.90 |
| June 13, 1902 | 10,000.00 |
| June 13, 1902 (allotment) | 5,000.00 |
| Total | 125,662.90 |

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COMMERCIAL STATISTICS.

*Classified statement of river traffic in Pittsburg Harbor for calendar year 1903.*

| Commodities. | Tons.[a] | Commodities. | Tons.[a] |
|---|---|---|---|
| Barges | 7,680 | Pig iron | 435 |
| Bark, tan | 365 | Poles, brace | 2,400 |
| Bottoms, coal boat, new | 23,076 | Posts, pit, and check | 30,454 |
| Brick | 2,585 | Sand | 1,270,115 |
| Coal | 9,398,664 | Steel rails | 45,106 |
| Coke | 6,600 | Steel and iron products, miscellaneous | 69,318 |
| Farm, dairy, and orchard produce | 14,996 | | |
| General merchandise | 94,029 | Stone | 13,422 |
| Gravel | 1,056,223 | Ties, railroad | 13,578 |
| Lath | 339 | Timber | 134,733 |
| Lumber | 41,211 | Wood | 33 |
| Live stock, large | 3,086 | | |
| Live stock, small | 521 | Total | 12,240,360 |
| Manure | 5,341 | Passengers, number | 702,269 |
| Miscellaneous | 6,050 | | |

[a] 2,000 pounds.

NOTE.—In preparing this statement care was taken not to duplicate any items. It should be stated that at least eight-tenths of this commerce is stored in the harbor from a week to several months and then rehandled and shipped out, and the empties returned. The rehandling and return of empties are not considered in the table.

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### REPORT OF MR. H. C. GOULD, ASSISTANT ENGINEER.

*Dredging channel.*—No channel dredging was done during the year, except removal of a shoal caused by sunken coal boat just below the right channel pier of the Smithfield Street Bridge requiring thirty-two and one-half hours' work by hired dredge, costing $12 per hour for the dredge, towboat, and scows.

*Removal of abandoned structures, etc.*—In June, 1904, to comply with terms of agreement made in 1902, the Jones & Laughlin Steel Company invited bids from contractors for removal of the projecting slag-filled point on the Monongahela River near Hazelwood, and it is expected that work will be started early in July.

*Marking harbor lines, inspection and patrol.*—The established harbor lines were marked by concrete monuments, lettered posts, etc., as follows: In the Allegheny River, from the Sharpsburg Bridge to Brilliant, 2 miles, and changed line on wharf at Pittsburg three-fourths of a mile. In the Monongahela River, from Dam No. 2 to mouth of Youghiogheny River, 4 miles, and changes of the lines on Pittsburg wharf and near Dam No. 2. In the Ohio River triangulation was extended from the head of the river down main channel to foot of Brunot Island, 3 miles, and down the Brunot Island back channel, 1¼ miles, connecting at foot of the island with triangulation carried up from Davis Island in previous year. Connections were also made with the original base-line stations of the 1891 survey on Brunot Island.

All the established lines throughout the harbor have now been marked either by marks directly on the lines or by references from which the lines can be readily located.

Patrol of the rivers throughout the harbor was maintained, stopping and preventing violations of the laws a great many times and obtaining the removal of many improper deposits. Inspection of permit works and of other construction near the banks and supervision of the work of sand dredgers were continued.

The patrol and survey steamboat *Loma* was kept in commission all the year, requiring but few repairs.

The naphtha launch *Luzon* was in use all the year, except when laid up during cold weather, from December 22 to March 26, and about two weeks at other times for repairs to propeller and machinery.

*Changes of harbor lines.*—On application of the National Tube Company, and after examination and recommendation by this office, a change of harbor line on right bank Monongahela River at McKeesport was approved October 5, 1903, on condition that a projecting filled point be removed by the applicants before October 13, 1905. By this removal a material increase in width of the river will be obtained.

On application of the Carnegie Steel Company and recommendation by this office a change of the harbor line on left bank of Monongahela River at Dam No. 2 was approved May 20, 1904.

*Miscellaneous.*—Relocations of harbor-line markings were made at many places where the marks had been destroyed by floods or by changes in railroads and other structures along the banks. New bridge piers and some new structures on the banks were located and placed on the maps.

The preparation of a new set of maps of the Pittsburg harbor lines was started in order to show present conditions, details of markings, etc. Three sheets were partly finished.

Details of work on extension of harbor lines down Ohio River and up Monongahela River are given elsewhere in reports for those rivers.

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## E E 5.

## OPERATING AND CARE OF DAVIS ISLAND DAM, OHIO RIVER, NEAR PITTSBURG, PENNSYLVANIA.

A detailed description of the operation of this lock during the fiscal year ending June 30, 1904, will be found in the attached report of Assistant Engineer William Martin.

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ALLOTMENT OF FUNDS.

| | |
|---|---|
| August 3, 1885 | $5,865.00 |
| July 10, 1886 | 12,015.00 |
| January 28, 1887 | 6,700.00 |
| July 1, 1887 | 12,355.00 |
| February 25, 1888 | 3,500.00 |
| July 11, 1888 | 18,015.00 |
| August 20, 1889 | 12,073.00 |
| May 14, 1890 | 2,000.00 |
| July 17, 1890 | 14,752.00 |
| October 7, 1890 | 14,800.00 |
| July 10, 1891 | 10,338.00 |
| July 21, 1892 | 11,831.48 |
| June 27, 1893 | 1,300.00 |
| July 22, 1893 | 12,253.82 |
| July 18, 1894 | 12,459.02 |
| May 25, 1895 | 450.00 |
| July 9, 1895 | 30,661.54 |
| July 28, 1896 | 15,531.57 |
| May 17, 1897 | $1,200.00 |
| July 23, 1897 | 9,898.62 |
| November 20, 1897 | 400.00 |
| July 26, 1898 | 9,620.71 |
| February 7, 1899 | 3,000.00 |
| June 24, 1899 | 1,200.00 |
| July, 19, 1899 | 23,459.69 |
| January 13, 1900 | 3,230.00 |
| June 18, 1900 | 45,000.00 |
| July 17, 1900 | 47,456.07 |
| February 26, 1901 | 2,000.00 |
| June 28, 1901 | 10,000.00 |
| July 18, 1901 | 42,530.54 |
| August 8, 1902 | 23,889.09 |
| July 20, 1903 | 65,107.55 |
| Total | [a]484,892.70 |

[a] Of this amount there was undrawn or deposited $1,010.

### ABSTRACT OF CONTRACT IN FORCE.

*Building 435 linear feet of movable dam, together with two abutments and two piers, on the site of the present fixed dam; also rebuilding the apron of the present fixed dam, at the back channel, Davis Island, Ohio River.*

Contractor: The Dravo Contracting Company, Pittsburg, Pa.

Rates: Common excavation, 75 cents per cubic yard; common filling, 75 cents per cubic yard; stone, $3 per cubic yard; concrete, $7.70 per cubic yard; oak timber (permanent), $60 per M feet B. M.; hemlock timber, $35 per M feet B. M.; white pine timber (permanent), $40 per M feet B. M.; oak sheet piling, $70 per M feet B. M.; cast iron, 7½ cents per pound; wrought iron and steel, 7½ cents per pound; bolts, nuts, washers, spikes, etc., 7½ cents per pound; rectangular tile pipe, 25 cents per linear foot.

Date of approval: November 23, 1903.

Date of beginning work: May 25, 1904.

Date of expiration: 125 fair working days.

*Classified statement of expenditures incurred in operating and care of the Davis Island dam, Ohio River, during the fiscal year ending June 30, 1904.*

| Item. | Amount. |
|---|---|
| Salaries and wages | $9,748.35 |
| Miscellaneous supplies and services | 2,548.88 |
| Miscellaneous repairs to lock and dam, operating machinery, etc | 6,384.10 |
| Rebuilding back channel dam | 607.50 |
| Total | 19,288.83 |

*Commerce passing Davis Island dam, Ohio River, during fiscal year ending June 30, 1904.*

| | Number. | Tons.[a] |
|---|---|---|
| Packets | 396 | |
| Towboats | 2,067 | |
| Model barges | 66 | |
| Coal boats | 3,021 | |
| Barges | 4,489 | |
| Flats | 2,426 | |
| Rafts | 30 | |
| Miscellaneous | 449 | |
| Coal | | 3,156,184 |
| Iron and steel products | | 35,411 |
| Sand | | 3,600 |
| Gravel | | 800 |
| Lumber | | 17,223 |
| Miscellaneous | | 75,997 |
| Total | 12,944 | 3,289,215 |

[a] 2,000 pounds.

### REPORT OF MR. WILLIAM MARTIN, ASSISTANT ENGINEER.

No unusual changes or repairs were necessary in the movable dam during the year, except the renewal of a few horses and wickets in the weirs. This was done during the several periods of raising the dam.

The bear-trap chute continues to perform its functions. It is now 15 years old and the timber composing the gate has become so soft that repairs are difficult to make. Nothing but a complete renewal of this part of the dam will justify any considerable expenditure.

The lower lock-gate valves were changed, balanced butterfly valves being substituted for the old valves. The service is greatly improved as to the time required to make a lockage.

The steam launch *Wenonah* continues to render good service in the various duties necessary in operating the dam.

During the year a contract for building 435 linear feet of movable dam of the drum type in the back channel at Davis Island was let to the Dravo Contracting Company, of Pittsburg, Pa., under date of October 17, 1903. The contractor began work March 21, 1904, and has at the close of this report removed complete 150 feet of the old structure and dismantled a considerable portion of the balance. No useful work except excavation has yet been done. The quantity of work accomplished is 2,300 cubic yards of common excavation.

During the year the dam was raised eight and lowered seven times, the greatest number of maneuvers in a year, as follows:

| Raised. | Lowered. | Time up. |
|---|---|---|
| | | *Days.* |
| July 16, 1903 | July 19, 1903 | 4 |
| July 26, 1903 | August 28, 1903 | 34 |
| September 5, 1903 | October 9, 1903 | 35 |
| October 14, 1903 | November 17, 1903 | 35 |
| November 26, 1903 | December 4, 1903 | 8 |
| December 5, 1903 | December 20, 1903 | 15 |
| May 11, 1904 | May 18, 1904 | 8 |
| June 13, 1904 | | 17 |
| Total | | 156 |

## E E 6.

## CONSTRUCTION OF LOCKS AND DAMS, NOS. 2-7, INCLUSIVE, OHIO RIVER IN PENNSYLVANIA.

A detailed description of the work done during the fiscal year ending June 30, 1904, will be found in the attached reports of Assistant Engineers William Martin and W. H. Chadbourn, jr.

### *Money statement.*

CONSOLIDATED.

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $1,079,580.04 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $243,094.03 | |
| For maintenance of improvement | 68,188.56 | |
| | | 311,282.59 |
| July 1, 1904, balance unexpended | | 768,297.45 |
| July 1, 1904, outstanding liabilities | | 7,521.46 |
| July 1, 1904, balance available | | 760,775.99 |
| July 1, 1904, amount covered by uncompleted contracts | | 464,189.27 |
| Amount (estimated) required for completion of existing project | | [a]2,393,376.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | | 2,393,376.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | | |

---

[a] On December 5, 1903, this Office submitted, in compliance with department letter of October 28, 1903, revised estimate for completion of Locks and Dams 3, 4, 5, and 7, Ohio River. The amount stated as required for completion of existing project in money statement is in accordance with the revised estimate so submitted.

### DAMS NOS. 2, 3, 4, AND 5.

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $921,227.32 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $135,662.90 | |
| For maintenance of improvement | 68,188.56 | |
| | | 203,851.46 |
| July 1, 1904, balance unexpended | | 717,375.86 |
| July 1, 1904, outstanding liabilities | | 3,604.68 |
| July 1, 1904, balance available | | 713,771.18 |
| July 1, 1904, amount covered by uncompleted contracts | | 439,442.18 |
| Amount (estimated) required for completion of existing project | | [a]1,441,376.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | | 1,441,376.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | | |

### DAM NO. 6.

| | |
|---|---|
| July 1, 1903, balance unexpended | $144,620.82 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 102,681.57 |
| July 1, 1904, balance unexpended | 41,939.25 |
| July 1, 1904, outstanding liabilities | 1,927.78 |
| July 1, 1904, balance available | 40,011.47 |
| July 1, 1904, amount covered by uncompleted contracts | 24,000.00 |

### DAM NO. 7.

| | |
|---|---|
| July 1, 1903, balance unexpended | $13,731.90 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 4,749.56 |
| July 1, 1904, balance unexpended | 8,982.34 |
| July 1, 1904, outstanding liabilities | 1,989.00 |
| July 1, 1904, balance available | 6,993.34 |
| Amount (estimated) required for completion of existing project | 952,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 952,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

---

[a] On December 5, 1903, this office submitted, in compliance with Department letter of October 28, 1903, revised estimate for completion of Locks and Dams Nos. 3, 4, 5, and 7, Ohio River. The amount stated as required for completion of existing project in money statement is in accordance with the revised estimate so submitted.

APPROPRIATIONS.

| | |
|---|---|
| September 19, 1890, construction of Lock and Dam No. 6 | $250,000 |
| July 13, 1892, construction of Lock and Dam No. 6 and purchase of land for No. 2 | 100,000 |
| August 18, 1894, construction of Lock and Dam No. 6 | 75,000 |
| March 2, 1895, construction of Lock and Dam No. 6 | 150,000 |
| June 3, 1896: | |
| Construction of Lock and Dam No. 6 | 25,000 |
| Construction of Locks and Dams Nos. 2, 3, 4, and 5 and purchase of sites for Nos. 3, 4, and 5 | 30,000 |
| June 4, 1897: | |
| Construction of Dams Nos. 2, 3, and 4 | 400,000 |
| Construction of Dam No. 6 | 300,000 |
| July 1, 1898, continuing construction of Dams Nos. 2, 3, 4, and 5 | 595,000 |
| March 3, 1899, continuing construction of Dams Nos. 2, 3, 4, and 5 | 400,000 |
| June 6, 1900, continuing construction of Dams Nos. 2, 3, 4, and 5 | 595,000 |
| June 13, 1902: | |
| Continuing construction of Locks and Dams Nos. 2, 3, 4, and 5 | 100,000 |
| Completing Lock and Dam No. 6 | 175,000 |
| Construction of Lock and Dam No. 7 | 23,000 |
| March 3, 1903, continuing construction of Dams Nos. 2, 3, 4, and 5 | 300,000 |
| Total | 3,518,000 |

ABSTRACT OF CONTRACTS IN FORCE.

*Drilling test holes at each of Dams Nos. 2, 3, 4, and 5, Ohio River.*

Contractor: The Preslar-Crawley Manufacturing Company, Cincinnati, Ohio.
Rates:
Drilling through loose material, $2.50 per linear foot.
Drilling into rock, $3.50 per linear foot.
Date of approval:[a]
Date of beginning work: May 15, 1902.
Date of expiration: 90 fair working days.

*Dredging at Dam No. 2, Ohio River.*

Contractor: The Evansville Contract Company, Pittsburg, Pa.
Rate: 39 cents per cubic yard.
Date of approval: October 11, 1902.
Date of beginning work: October 31, 1902.
Date of expiration: 100 fair working days (extended for a reasonable period).

*Paving slopes on esplanade at Lock No. 2, Ohio River.*

Contractor: The Evansville Contract Company, Pittsburg, Pa.
Rate: $1.25 per square yard.
Date of approval: October 13, 1902.
Date of beginning work: November 1, 1902
Date of expiration: 50 fair working days.

*Dredging near Dam No. 3, Ohio River.*

Contractor: Monongahela and Western Dredging Company, Pittsburg, Pa.
Rates:
Dredging, 33 cents per cubic yard.
Material deposited behind land wall at Lock No. 3, 22 cents per cubic yard.
Date of approval: June 17, 1902.
Date of beginning work: July 21, 1902.
Date of expiration: March 21, 1903 (extended for a reasonable period).

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[a] Emergency.

*Constructing 500 feet of Chanoine dam and its protection crib at Dam No. 4, Ohio River, and for modification of cofferdam.*

Contractor: Ætna Construction Company, Wheeling, W. Va.

Rates, original contract: Cofferdam, $15 per linear foot; round piling, 30 cents per linear foot; sheet piling, 35 cents per linear foot; common excavation, 40 cents per cubic yard; rock excavation, $1 per cubic yard; bolt holes, 50 cents per linear foot; stone filling, $2.50 per cubic yard; gravel filling, 30 cents per cubic yard; esplanade filling, 35 cents per cubic yard; concrete masonry, $3.50 per cubic yard; oak timber (permanent), $45 per M feet B. M.; hemlock timber (permanent), $25 per M feet B. M.; cast iron, 4 cents per pound; wrought iron and steel, 4 cents per pound; bolts, nuts, washers, spikes, etc., 4 cents per pound; wrought-iron pipe, 3-inch diameter, 50 cents per linear foot; wrought-iron pipe, 4-inch diameter, 60 cents per linear foot. Channel dredging and bank protection: Channel dredging, 30 cents per cubic yard; round piling, 30 cents per linear foot; oak timber, $45 per M feet B. M.; bolts, nuts, washers, etc., 4 cents per pound; stone filling, $2 per cubic yard.

Rates, supplemental contract: For so much material as would be required to construct a cofferdam 12 feet wide and 15 feet high (these being the average dimensions of the cofferdam provided for in the original contract), $15 per linear foot; for all material in place in excess of the amount required to construct a cofferdam 12 feet wide and 15 feet high, hemlock timber, $45 per M feet B. M.; bolts, nuts, and washers 6 cents per pound; gravel filling, $1.15 per cubic yard.

Dates of approval:
Original contract, July 18, 1901.
Supplemental contract, May 26, 1902.
Additional supplemental contract, June 2, 1904.

Date of beginning work: Original contract, September 20, 1901.

Date of expiration:
Original contract, 250 fair working days.
Supplemental contract, 60 additional days.

*Building about 400 feet of Chanoine dam (excepting the movable parts), complete, for navigable pass of Dam No. 5, Ohio River.*

Contractor: Robert A. Cummings, Pittsburg, Pa.

Rates: Hemlock timber, $35 per M feet B. M.; oak timber, $70 per M feet B. M.; sheet piling, $50 per M feet B. M.; round piling, 50 cents per linear foot; stone filling, $3.50 per cubic yard; common filling, 50 cents per cubic yard; common excavation, 50 cents per cubic yard; iron and steel, 4 cents per pound; wire rope, 7 cents per linear foot; wire-rope clips, 30 cents each; iron pipe, 2-inch, 35 cents per linear foot; iron pipe, 3-inch, 60 cents per linear foot; iron pipe, 4-inch, 80 cents per linear foot; concrete, $7.50 per cubic yard.

Date of approval: September 18, 1902.

Date of beginning work: November 18, 1902.

Date of expiration: 200 fair working days.

*Building two masonry piers and south shore abutment of Dam No. 6, Ohio River.*

Contractor: The Evansville Contract Company, Pittsburg, Pa.

Rates: Brick masonry, $15 per cubic yard; coping masonry, $20 per cubic yard; ashlar masonry, $12.50 per cubic yard; dimension stone, $20 per cubic yard; common filling, 65 cents per cubic yard; common excavation, 65 cents per cubic yard; iron and steel, 5 cents per pound; iron pipe, 3-inch, 75 cents per linear foot; iron pipe, 4-inch, $1 per linear foot; concrete, $7.50 per cubic yard; for stone furnished by the United States, $10 per cubic yard, and for cement furnished by the United States, $1.75 per barrel, shall be deducted from moneys due or to become due the contractor.

Date of approval:[a]

Date of beginning work: October 20, 1902.

Date of expiration: 60 fair working days (extended for a reasonable period).

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[a] Emergency.

### Furnishing Atlas Portland cement for Dams Nos. 4 and 6, Ohio River.

Contractor: Atlas Portland Cement Company, New York, N. Y.
Rates: F. o. b. cars, Legionville, Pa., $2.34 per barrel; f. o. b. cars, Merrill, Pa., $2.34 per barrel.
Date of approval: May 15, 1903.
Date of beginning work: 15 days after date of order.
Date of expiration: December 31, 1903.

### Furnishing all the necessary labor, material, and appliances, and constructing, erecting in place, and completing two steel lock gates at Lock 6, Ohio River.

Contractor: Penn Bridge Company, Beaver Falls, Pa.
Rate: $30,000 for the two gates.
Date of approval: July 2, 1903.
Date of beginning work: July 18, 1903.
Date of expiration: July 18, 1904.

### Building a power house, except foundation, at Dam No. 6, Ohio River.

Contractor: The W. W. Wood Company, Wheeling, W. Va.
Rate: $15,880.
Date of approval: July 9, 1903.
Date of beginning work: August 14, 1903.
Date of expiration: 90 fair working days.

### Building two lock-keepers' houses, except foundations, at Dam No. 6, Ohio River, near Merrill, Pa.

Contractor: T. J. Williams, Pittsburg, Pa.
Rates: $5,671 for each building; $30 for each of five mantels, grates, and hearths for each house.
Date of approval: September 22, 1903.
Date of beginning work: October 14, 1903.
Date of expiration: March 14, 1904.

### Building about 600 feet Chanoine dam for navigable pass, Dam No. 3, Ohio River.

Contractor: The Evansville Contract Company, Parkersburg, W. Va.
Rates: Excavation, 50 cents per cubic yard; hemlock timber, $50 per M. feet B. M.; oak timber, $70 per M. feet B. M.; concrete, $9 per cubic yard; stone filling (crib), $3 per cubic yard; stone filling (below crib), $3 per cubic yard; common filling (crib), 50 cents per cubic yard; common filling (above dam), 15 cents per cubic yard; cast iron, 6 cents per pound; medium steel, 6 cents per pound; reenforcing steel, 6 cents per pound; 3½-inch galvanized-iron pipe, 75 cents per linear foot; 4-inch galvanized-iron pipe, $1 per linear foot; sheet piling, $80 per M. feet B. M.
Date of approval: October 27, 1903.
Date of beginning work: June 30, 1904.
Date of expiration: 125 fair working days.

### Reconstructing about [illegible] linear feet of land wall at Dam No. 5, Ohio River.

Contractor: Ætna Construction Company, Wheeling, W. Va.
Rates: Concrete, $7.75 per cubic yard; coping stone in place, $5 per cubic yard.
Date of approval: (a)
Date of beginning work: October 26, 1903.
Date of expiration: 30 fair working days.

### Placing about [illegible] tons, more or less, of riprap stone in lock chamber at Lock No. 5, Ohio River.

Contractor: Ætna Construction Company, Wheeling, W. Va.
Rate: $2.10 per ton.
Date of approval: (a)
Date of beginning work: October 27, 1903.
Date of expiration: November [illegible], 1903.

---

[a] Emergency.

*Building 376 feet of Chanoine dam and a bear-trap dam 102 feet 4 inches wide, Dam No. 2, Ohio River.*

Contractor: E. Brown Baker, Pittsburg, Pa.

Rates: Excavation, 90 cents per cubic yard; hemlock timber, $60 per M feet B. M.; oak timber, $65 per M feet B. M.; white pine timber, $60 per M feet B. M.; cast iron, 5 cents per pound; medium steel, 6 cents per pound; bolts and washers, 4 cents per pound; concrete, $7.25 per cubic yard; reenforcing steel, 3 cents per pound; stone filling (crib), $3 per cubic yard; riprap stone, $3.50 per cubic yard; common filling, 40 cents per cubic yard; drift bolts, 4 cents per pound; 3½-inch galvanized-iron pipe, 50 cents per linear foot; 4-inch galvanized-iron pipe, 60 cents per linear foot; brick paving, $4 per square yard; block-stone paving, $4 per square yard; sheet piling, $70 per M feet B. M.

Date of approval: February 13, 1904.

Date of beginning work: April 17, 1904.

Date of expiration: April 17, 1906.

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## REPORT OF MR. WILLIAM MARTIN, ASSISTANT ENGINEER.

*Dam No. 2.*—The contracts in force at this site are paving the slopes on the esplanade and dredging a channel 200 feet wide and 4,000 feet in length, both under contract with the Evansville Contract Company; also building 376 feet of Chanoine dam and a bear trap 102 feet 4 inches wide, under contract with E. Brown Baker. No work has been done during the year on the contract for paving the esplanade slopes, for the reason that the gravel filling to the grade lines, as required, has not yet been completed.

The contract for dredging the channel to the extent of 90,000 cubic yards of excavation is still in progress. Sixty-one thousand six hundred and ninety-eight cubic yards of the 90,000 have been performed. Thirty-five thousand cubic yards of the total quantity were required to be deposited on the esplanade, 22,000 cubic yards of which have been so delivered.

The contract with E. Brown Baker is for 200 feet of Chanoine dam for the navigable pass, 102 feet 4 inches of bear-trap dam, with 2 piers and 176 feet of weir with a masonry abutment. Work was commenced on this contract in May. Two hundred and sixty feet of the abutment crib have been sunk into position, and the principal excavation for the weir and bear trap has been made.

The materials furnished and placed, and work done during the year, were as follows:

| | | |
|---|---|---|
| Common filling | cubic yards.. | 2,000 |
| Driftbolts | pounds.. | 4,000 |
| Excavation | cubic yards.. | 10,500 |
| Hemlock timber | feet B. M.. | 84,000 |

*Dam No. 3.*—The contracts in force at this site are: Dredging a channel 300 feet wide and about 5,000 feet in length; the removal of the reef left between the new and old channel (both these contracts were with the Monongahela and Western Dredging Company); the building of a pile and timber guard to aid ascending boats during low water, by the Jutte & Foley Company; and building 600 feet length of Chanoine dam, by the Evansville Contract Company.

The contract for the 300-foot channel has been completed. Five hundred and eighty-five and ninety-four hundredths cubic yards of material were removed during the year. The total amount of material removed under this contract was 134,723.22 cubic yards.

The reef lying between the old and new channel was removed by the same company under oral agreement. Forty-six thousand and sixty-nine and ninety-two hundredths cubic yards of material were removed.

The pile and timber guard lacks two courses of timber facing to complete.

The building of 600 feet of Chanoine dam was commenced in the fall of 1903, but owing to the lateness of the season the contractor failed to successfully sink the foundation crib. It was carried away by a rise in the river. No useful work has been accomplished, as the trench for the foundation crib filled up during the winter.

*Dam No. 4.*—The contracts in force during the year at this site were with the Ætna Construction Company for building 500 feet of Chanoine dam, and the Prelar-Crawley Manufacturing Company for boring test holes.

Of the former contract, but 250 feet of dam was built; and by additional supplemental articles of agreement it was mutually agreed to terminate said contract without prejudice to either party, the United States purchasing material from the contractor, such as timber, riprap stone, and iron for the movable parts of the dam.

The materials furnished and placed and work done by the contractor, under the original contract, were as follows:

| | | |
|---|---|---|
| Sheet piling | linear feet.. | 934 |
| Round piling | do.... | 4,237 |
| Common excavation | cubic yards.. | 606 |
| Concrete masonry | do.... | 1,690 |
| Oak timber (permanent) | feet B. M.. | 139,820 |
| Hemlock timber | do.... | 1,428 |
| Stone filling | cubic yards.. | 2,442 |
| Gravel filling | do.... | 670 |
| Cast iron | pounds.. | 47,087.8 |
| Wrought iron and steel | do.... | 7,474 |
| Bolts, washers, etc | do.... | 27,117.75 |
| Wrought iron pipe, 3-inch | linear feet.. | 295 |
| Wrought iron pipe, 4-inch | do.... | 146.5 |

Materials furnished and delivered under additional supplemental agreement:

| | | |
|---|---|---|
| Oak timber | feet B. M.. | 102,941 |
| Cast iron | pounds.. | 85,300 |
| Bolts and nuts | do.... | 38,604 |
| Wrought iron and steel | do.... | 38,500 |
| Riprap stone | tons.. | 1,200 |

Six test holes were drilled at the site of the abutment on the left shore by the Preslar-Crawley Manufacturing Company.

Both these contracts have been completed.

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## REPORT OF MR. W. H. CHADBOURN, JR., ASSISTANT ENGINEER.

*Dam No. 5.*—At the beginning of the fiscal year the masonry of the lock was completed, but the land and river walls and a short length of the lower guide wall were undermined in places, and the land wall had settled and bulged outward for about 150 feet of its length. The cofferdam around 400 feet of the dam was built, but the lower arm had washed away, as had also the filling from the outer arm.

During the fiscal year the lock walls were repaired, and the lock chamber was thoroughly protected with riprap. This work was done principally by hired labor and use of United States plant, the concrete work and placing of riprap being done under contract.

The damaged portion of the land wall—about 150 linear feet—was removed and the débris excavated to −18 feet, involving the removal of about 6,000 cubic yards of material from behind the old wall and 1,300 cubic yards of damaged concrete. This material was utilized to fill up the lock area at upper end. A crib 16 feet wide was then built, up to −5 feet, and carefully filled and packed with gravel; on top of this a concrete wall was constructed, and the old coping replaced. About 6,000 cubic yards of gravel were then placed behind the wall.

The river wall was found to be entirely undermined for a length of 50 feet. About 4 feet of the concrete foundation had separated from the rest of the wall and had fallen into the hole scoured under and around the wall, leaving a clear space of from 2 to 4 feet entirely under the wall. Heavy oak supports were placed under the wall and wedged tightly, and the remaining space was carefully filled and rammed with stone. Thin concrete walls were then constructed on both sides of the river wall along the damaged part, extending above the break, and then large quantities of pure cement grout were poured into the basin thus provided. This was continued until the space would take no more, about 700 barrels of Portland cement being used in the operation. This work was very expensive owing to the large quantity of water that had to be pumped, the temporary platforms, etc., that had to be built to support the machinery, and the numerous cofferdams and bulkheads that had to be constructed to isolate certain parts. The season was a most trying one for this kind of work, numerous freshets at frequent intervals flooding the cofferdams and damaging the work in unfinished condition.

The lower guide wall, near the gate recess, was repaired in December, 1903, by ramming concrete between the settled portion and the part that was intact.

While the lock was pumped out, it was thought advisable to riprap the entire lock floor with heavy riprap to prevent damage in the future. Four thousand and twenty-three tons of riprap were purchased by the United States and placed, under contract with the Ætna Construction Company, dated October 27, 1903.

After suspension of the contract work on the dam for the season, the United States pumped out the lock to complete the riprapping, and the water in the dam cofferdam was thereby lowered to −3 feet, with the stage in the river about +6 feet. This showed conclusively that the efforts to stop the leak under the river wall were not successful. It is thought that the wall is secure.

The cost of these repairs was as follows:

| | |
|---|---|
| Lock chamber, riprapping, filling, etc | $22,432.34 |
| River wall, underpinned | 13,053.44 |
| Land wall, 150 feet rebuilt | 31,460.94 |
| Lower guide wall, 60 feet underpinned | 1,241.84 |
| Total | 68,188.56 |

The heavy cost of pumping, cofferdams, bulkheads, etc., was proportioned between these heads, as well as the high cost of the 2,519 cubic yards of heavy riprap dumped along the walls and in the lock chamber during winter of 1902-3 to prevent further damage, after the injury was first discovered, the cost of which was $8,575.55, as stated in report for fiscal year 1903.

A small retaining wall was built, running from the end of lower recess to the bank, at an expense of $816.09, in order to arrest further erosion, and it has served its purpose admirably.

Work on the 400 linear feet of substructure of Chanoine dam was côntinued under contract with Robert A. Cummings, dated August 16, 1902. On account of loss of part of the cofferdam, during winter of 1902-3, this work was greatly delayed, and after the cofferdam was repaired work was stopped several times by freshets.

The repairs to cofferdam which were under way at close of last fiscal year were completed September 1, 1903, and pumping commenced September 7. Work on permanent structure commenced October 2, 1903, and continued, with more or less interruption, until November 17, 1903, when work for the season was suspended on account of high water.

Following is a list of materials placed and excavation done during above period:

| | | |
|---|---|---|
| Hemlock timber | feet B. M. | 75,604.1 |
| Oak timber | do | 486.0 |
| Sheet piling | do | 27,586.0 |
| Round piling | linear feet | 601.5 |
| Stone filling | cubic yards | 2,237.2 |
| Common filling | do | 8,934.5 |
| Common excavation | do | 2,720.3 |
| Iron and steel | pounds | 57,652.8 |
| Iron pipe, 3-inch | linear feet | 180.0 |
| Iron pipe, 4-inch | do | 90.0 |
| Concrete | cubic yards | 1,596.0 |

The cofferdam was not damaged to any extent during the winter of 1903-4. About 2,000 cubic yards of heavy riprap were placed above the lower arm to protect it during the winter floods.

At close of the fiscal year the cofferdam was pumped out to −9 feet, and some work of excavation was in progress. No work on permanent structure has been done thus far this season.

The temporary cofferdams have been placed at both ends of the lock, and the lock has been pumped out by the United States. It was deemed unwise to subject the injured river wall to the strain which would come on it by pumping out the dam coffer. While the lock is unwatered the riprap will be more carefully placed, and the pipes will be laid in power conduit.

*Dam No. 6.*—At the beginning of the fiscal year the masonry of the lock, 600 linear feet of navigable pass (Chanoine type), two bear-trap weirs of 120 feet span each were completed; one weir of 120 feet span of A-frame dam was practically completed, and the abutment was built up to about sill level only.

The contract with the Evansville Contract Company, dated September 20, 1902, for the completion of two piers and abutment, was completed January 9, 1904. Under this contract the following materials were placed during the fiscal year:

| | | |
|---|---|---|
| Brick masonry | cubic yards.. | 13.3 |
| Coping masonry | do ..... | 52.7 |
| Ashlar masonry | do ..... | 147.3 |
| Dimension stone | do ..... | 75.0 |
| Common filling | do ..... | 1,703.4 |
| Common excavation (removed) | do ..... | 1,029.9 |
| Iron and steel | pounds .. | 940.7 |
| Iron pipe, 3-inch | linear feet.. | 25.7 |
| Iron pipe, 4-inch | do .... | 43.9 |
| Concrete | cubic yards .. | 397.7 |

Power house was built under contract with the W. W. Wood Company, dated May 29, 1903, for $15,890, being completed January 7, 1904.

Two lockkeepers' houses were built under contract with T. J. Williams, dated September 4, 1904, for $5,821 each. They were completed March 31, 1904.

The necessary machinery was installed in the power house, including boiler and air compressor. The lock-gate engines, gate-operating machinery, valve-operating machinery for lock and bear traps were all installed and all necessary connections were practically made. The maneuvering boat was completed during the year, and all necessary machinery installed in it.

Construction of the lock gates, under contract with the Penn Bridge Company, dated June 6, 1903, was commenced in March, 1904, and the work was still in progress at close of fiscal year. The upper gate was practically completed, except painting and decking, and the lower gate is all in place, but is not riveted. Valves and screens are not placed and not painted final coat. This contract expires August 2, 1904, and it is probable that both gates will be completed by that time.

As soon as the gates are completed it is contemplated to raise the dams and put the lock in operation, which, it is expected, will be attempted in latter part of July. The A-frame dam was left up last winter, it being evident that it would be so covered with sand and débris that it would be impossible to raise the structure without removing the débris at considerable expense. A large sand bar lies just above this weir, and it will have to be dredged out before the A-frame dam can possibly work satisfactorily.

The work yet to be done at this lock and dam consists of grading and paving the lock yard, completing the riprapping on abutment side of river, dredging a large bar at head of lock, purchasing site and building a dam tender's dwelling, placing iron covers for gate recesses, erecting electric-light plant, and placing cement walks, gutters, curbing, etc.

*Dam No. 7.*—The site of Dam No. 7 is in Pennsylvania, 36.5 miles below Pittsburg, Pa. The lock is to be located on the left bank of the river.

The major portion of the lock site has been finally acquired. One small plat on the lock side and the land on the abutment side have been condemned, but the titles are not yet vested in the United States.

A total of 20.54 acres (measuring to low water) has been acquired or condemned for this site—17.76 acres on the lock side and 2.78 acres on abutment side—at a total cost of $3,814. A large portion of the land—about 5½ acres—is above extreme flood stage of the river, and makes an admirable site for construction purposes and for use afterwards.

The lock plans have been completed, ready for advertising as soon as authority is given by Congress to proceed with the work.

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## E E 7.

## CONSTRUCTION OF LOCKS AND DAMS AT HERR ISLAND, ABOVE HEAD OF SIX-MILE ISLAND, AND AT SPRINGDALE, ALLEGHENY RIVER.

iled description of the work done during the fiscal year end-
, 1904, will be found in the attached report of Assistant
W. Arras.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $320,279.11 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 147,010.00 |
| July 1, 1904, balance unexpended | 173,269.11 |
| July 1, 1904, outstanding liabilities | 644.43 |
| July 1, 1904, balance available | 172,624.68 |
| July 1, 1904, amount covered by uncompleted contracts | 160,468.18 |
| Amount (estimated) required for completion of existing project | ([a]) |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| August 5, 1886 | $37,500 | June 4, 1897 | $350,000 |
| August 11, 1888 | 35,000 | July 1, 1898 | 300,000 |
| September 19, 1890 | 35,000 | March 3, 1901 | 126,000 |
| July 13, 1892 | 40,000 | June 28, 1902 | 118,500 |
| August 18, 1894 | 40,000 | | |
| June 3, 1896 | 50,000 | Total | 1,132,000 |

### ABSTRACT OF CONTRACTS IN FORCE.

*Constructing two locks and dams on Allegheny River at Six-mile Island (No. 2) and at Springdale (No. 3).*[b]

Contractors: Sloan, McIlvain & Ott Bros., Allegheny, Pa.

Lock and Dam No. 3.

**Rates**: Original contract. Lock and abutment. Grubbing and clearing, $142; earth excavation, 12 cents per cubic yard; hardpan excavation, 75 cents per cubic yard; rock excavation, $1.75 per cubic yard; embankment, $2.19 per cubic yard; concrete of natural cement, $4.18 per cubic yard; concrete of Portland cement, $5.57 per cubic yard; stone filling in cribs, $1 per cubic yard; stone paving of cribs, $1.10 per square yard; stone paving of river bank, $1.40 per square yard; white oak in gates, $47 per M feet B. M.; white oak in quoins and sills, $60 per M feet B. M.; white oak in cribs, abutments, and gate spars, $44 per M feet B. M.; hemlock in cribs, $19.50 per M feet B. M.; button-head driftbolts in cribs, 1$\frac{7}{8}$ cents per pound.

**Rates**: Original contract. Dam. White-oak timber, $30 per M feet B. M.; hemlock timber, $19.50 per M feet B. M.; white-oak sheeting on back of dam, $28 per M feet B. M.; riprap stone filling, $1.07 per cubic yard; button-head driftbolts, 1$\frac{7}{8}$ cents per pound; dredging, foundation, 16 cents per cubic yard; refilling for dam, 15 cents per cubic yard; backing of dam, 15 cents per cubic yard; hemlock piles in place, $4.32 each; hemlock sheeting and scantling, in foundation, $16 per M feet B. M.

**Rates**: Supplemental contract, covering additional work at the following prices: Oak piles, $8.62 each; white-oak lumber, $40 per M feet B. M.; hemlock lumber, $27.50 per M feet B. M.; button-head driftbolts, 3 cents per pound; protection stone below dam, $2.25 per cubic yard; riprap stone filling, if any, $1.20 per cubic yard; gravel filling in dam, 30 cents per cubic yard.

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[a] In report printed in House Document No. 371, Fifty-seventh Congress, first session, it was estimated that the completion of this project would cost $148,732 more than the limiting cost fixed by Congress.

[b] By supplemental contract dated November 29, 1901, approved by Secretary of War, December 13, 1901, this contract was abrogated so far as it pertained to lock and dam at Six-mile Island (No. 2).

Date of approval:
Original contract, July 8, 1897.
Supplemental contract, July 13, 1901.
Date of beginning work: May 25, 1898.
Date of expiration: September 26, 1901 (extended for a reasonable period).

*Building a lock, two guide walls, a guard crib, and abutment for dam at Six-mile Island, Allegheny River.*

Contractor: The Dravo Contracting Company, Pittsburg, Pa.

Rates: Rock excavation, $1.10 per cubic yard; hard-pan excavation, $1.10 per cubic yard; gravel excavation, $1.10 per cubic yard; concrete, $7.10 per cubic yard; oak timber, $62 per M feet B. M.; hemlock timber, $46.50 per M feet B. M.; stone ballast, $3.10 per cubic yard; paving, $4.65 per square yard; driftbolts, 5 cents per pound.

Date of approval: January 8, 1903.
Date of beginning work: April 1, 1903.
Date of expiration: November 15, 1904.

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### COMMERCIAL STATISTICS.

Commercial statistics are attached to reports for operating and care of Herr Island dam, Allegheny River, and improving Allegheny River, Pennsylvania.

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### REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

*Lock and dam at Six-mile Island* (*No. 2*).—The lock and abutment for the dam are being constructed by the Dravo Contracting Company, of Pittsburg, Pa., under a contract dated December 31, 1902. At the beginning of the fiscal year the cofferdam at the site of the lock was practically finished, and 5,659 cubic yards of gravel and rock excavation for lock foundation had been made.

Satisfactory progress was made. The requirement for a cofferdam built to an elevation of 10 feet above low water, thus excluding practically all of the numerous small rises which occurred during the working season, inuring greatly to the advancement of the work. Owing to the early setting in of severe winter weather, and the prolonged period of excessive freshets in the spring, but little work could be performed from November 15 until May. Nevertheless during the year the following work was accomplished: The excavation for the lock foundation, largely shaly rock, was completed; the concrete lock walls were completed, and all irons—hollow quoins, valves and valve-operating gearing, screens, snubbing posts, etc.—set; the concrete return wall at the head of the lock was completed; gravel cofferdams for both upper and lower guide walls were constructed; the excavation for the upper guide wall was made and nearly one-half of the concrete guide wall built, and about 50 per cent of the excavation for the lower guide wall, mostly shaly rock, made. All of the concrete walls were built in monolithic sections, approximately 30 feet in length, of concrete composed of one part American portland cement, three parts clean-washed river sand, and six parts small river gravel. The walls are faced with a scant inch of cement and sand mortar placed simultaneously with the concrete. The greater part of all excavated materials was deposited, as required, landward of the structure, where it would enter into the formation of the embankment there needed eventually.

Progress on the abutment for the dam was not nearly so satisfactory, which may perhaps be wholly attributed to the method of construction pursued. The substructure of the abutment below and superstructure above the low-water line are to consist of cribwork and concrete, respectively. The structure was located well into the steep bank, beyond which projected a comparatively high beach. No cofferdam being necessary, the conditions were therefore exceptionally favorable for the prosecution of this work in the dry by unwatering the excavation for the cribwork substructure as it progressed down to its bottom reference of 15 feet below low water, and with a little judicious shoring there is no doubt that the main bank could have been properly supported and prevented from sliding or caving. Instead the contractor entered upon this undertaking with a dredge, first excavating a channel through the beach to the location of the abutment. As the excavation proceeded, necessarily the bank began to cave, which caving increased during the fall rises until several thousand cubic yards of material had gone into the hole and been removed at considerable expense, and the safety of a large brick house, originally more than 50 feet from the edge of the bank, was threatened. In this condition winter overtook the work with only one of the two submerged cribs in position. Fortunately the excessive winter and spring freshets did not greatly extend the caving of the bank, and at the first approach of low water in the spring the gap provided for the movements of the dredge was closed and the inclosure unwatered. At the close of the year nearly all of the cribwork was in place and partially filled with stone, and considerable of the sheet piling along the river face of the abutment driven. The caving of the bank back of the structure is unfortunate, not only in the loss to the contractor which it represents, but as well in that it must of necessity result in a less secure structure with greater liability to leakage through the loose fill behind it.

Of the construction of the lock and abutment under this contract there remain yet to be done the placing of the concrete lock floor, building of miter and guard sills, completion of guide walls and guard crib, and completion of abutment.

The materials furnished and placed and work performed by the contractor during the year were as follows:

| | | |
|---|---|---|
| Excavation | cubic yards | 15,198 |
| Concrete | do | 17,529 |
| Hemlock timber | feet B. M. | 25,060 |
| Driftbolts | pounds | 1,068 |

From the inception of this improvement it has been the purpose of the city of Pittsburg to extend the 9-foot sewer emptying just above the lock so as to discharge below it, in order to protect its water supply, which is drawn from the river within one-fourth mile above the site of the dam. A contract for the sewer extension was recently let by the city, and considerable progress on the work has already been made.

*Lock and dam at Springdale (No. 3).*—So frequent and prolonged were the rises and freshets of the past year as to completely baffle all efforts of the contractor to complete this work. Throughout the entire year the scattered periods of low water permitting operations at the lower level of the work did not aggregate more than thirty days. These occurring in August, September, and November, were taken advantage of and the work materially advanced. At the beginning of the year the cribwork of the dam was in place to an elevation of 1 foot above low water, but lacked a small amount of sheeting on the upstream face, some piles and large stone protection at the downstream face, and considerable gravel and stone filling. During the year the sheeting on the upper face of the dam was completed; most of the remainder of the apron of the dam was filled with stone and decked; the cribwork of the dam was raised to heights varying from 4 feet above low water at the abutment to full height at the lock, and considerable stone and gravel filling placed in it, and about 50 linear feet of top decking was placed on the dam. At the close of the year rapid progress was being made on 500 linear feet of the dam, but the water still continued too high to resume operations on the low part adjoining the abutment.

On the lock the upper lock gates were constructed and placed, the two filling valves set, part of the valve operating gearing installed, the timbers for the lower lock gates framed, and a small quantity of material deposited in the embankment back of the lock. No attempt was made to complete the abutment, which has been constructed to the elevation of the crest of the dam.

Late in the season of 1903 considerable difficulty arose concerning navigation over the unfinished structure. The lower lock gates not having been erected no lockages could be made, and navigators at first feared to run over the dam. After some delay, permitting a considerable reduction in the stage of water, the upper lock gates were opened and the majority of the barges, boat bottoms, rafts, etc., moored above the dam passed through the lock, suffering slight damage. The remainder, about 40 pieces, were left to await a higher stage of water, but almost immediately the river closed with ice, and more than one-half of them were destroyed by the tremendous ice gorges which followed. After the winter's ice had run out the heavy spring run of timber products passed over the dam comparatively uninjured. Except for the loss by the contractor of a few timbers on the unfinished, unprotected cribwork of the dam the work suffered no material injury from the winter's freshets and ice.

On this work there remains yet to be done the completion of upper portion of dam and abutment, back filling of dam, erection in place of lower lock gates, and paving of guard cribs at lock.

**Statement of materials furnished and placed, and work done during the fiscal year in addition to placing valves, irons, etc., furnished by the United States is as follows:**

| | | |
|---|---|---|
| Embankment | cubic yards.. | 240 |
| Gravel filling in dam and backing | do.... | 7,265 |
| Stone ballast | do.... | 4,527 |
| White oak timber | feet B. M.. | 98,620 |
| Hemlock timber | do.... | 145,922 |
| Driftbolts | pounds.. | 19,020 |

## E E 8.

## OPERATING AND CARE OF HERR ISLAND DAM (NO. 1), ALLEGHENY RIVER.

A detailed statement of the operation of this lock during the fiscal year ending June 30, 1904, will be found in the attached report of Asst. Engineer, J. W. Arras.

ALLOTMENTS OF FUNDS.

| | |
|---|---|
| January 9, 1903 | $9,610.00 |
| July 20, 1903 | 18,292.64 |
| Total | 27,902.64 |

*Classified statement of expenditures incurred in operating and care of Herr Island dam, Allegheny River, for the fiscal year ending June 30, 1904.*

| Item. | Amount. |
|---|---|
| Salaries and wages | $11,340.00 |
| Miscellaneous supplies and services | 3,495.61 |
| Contingencies | 1,369.32 |
| Total | 16,204.93 |

COMMERCE PASSING HERR ISLAND DAM, ALLEGHENY RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

| | Number. | Tons.[a] |
|---|---|---|
| Steamboats | 5,515 | |
| Coal boats, barges, flats, etc | 11,342 | |
| Rafts | 237 | |
| Other craft | 284 | |
| Barges, flats, etc. (new) | | 8,520 |
| Bark | | 545 |
| Bottoms, coal boat (new) | | 21,096 |
| Coal | | 179,928 |
| Farm products | | 1,776 |
| General merchandise | | 210 |
| Gravel | | 388,719 |
| Iron products | | 415 |
| Lath | | 507 |
| Lumber | | 23,355 |
| Poles, brace | | 3,480 |
| Posts, check, pit, etc | | 20,224 |
| Sand | | 374,196 |
| Stone | | 2,612 |
| Ties, railroad | | 5,902 |
| Timber | | 34,748 |
| Total | | 1,066,232 |
| Passengers | 2,173 | |

[a] 2,000 pounds.

Number of lockages, 3,477.

REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

Prior to the past fiscal year this structure had been open to navigation for six months and the dam had been raised once, remaining up for only twenty-one days. During the year opportunity was afforded for testing it thoroughly in every respect through the frequency of rises necessitating the maneuvering of the dam in whole or in part very often. No difficulty whatever was experienced with either the lock or dam, and the operation of the bear-trap weirs, which were required every few days for flushing the pool or removing drift and ice, were quite satisfactory. When the bear-trap weirs were first raised, on June 2, 1903, after making slight modifications by way of reducing possible leakage between the gates, and constructing below the head culvert openings small spur deflecting shutters for the purpose of increasing the effective operating head, it was believed that the principal cause for failure of the gates to rise originally had been discovered. But subsequently, since practically all of the attachments made to modify the gates have disappeared and the gates operate more readily than before, it seems probable that the cause of their refusal to operate originally has not yet been determined. During the year they were operated a great many times, both from necessity and for experimental purposes, and always with the same facility and promptness. The larger one, with a vertical height of 12 feet, was raised several times without the aid of the pneumatic force, under a head of 5 or 6 feet. With a similar head, assisted by some air pumped into the lower gate, the process of lowering and raising this gate requires from six to ten minutes.

Early in July, 1903, after both bear-trap weirs had been down continuously for two days owing to a protracted rise, it was discovered that the river bed below them had scoured to such an extent as to threaten the stability of the retaining wall below the abutment. Three hundred and fifty cubic yards of large stone and some gravel were placed in front of the wall, which checked the scour and prevented permanent injury to it. Subsequently about 1,000 cubic yards of stone and other heavy materials were deposited in the depression below larger bear-trap.

Four small blocks of concrete, aggregating about 40 cubic yards, which had been omitted about the anchorage of the lock gates, were constructed.

Notwithstanding the great number and excessiveness of the freshets which occurred during the year, and the heavy ice gorges accompanying them during the latter months of the winter, the only damage sustained by the work was the breaking of two valve-operating sectors and a check-post on the head of the upper guard crib, and slight injury to the maneuvering boat. The former were replaced and the latter repaired. Twice the lock gorged full of ice from the floor almost to the top of the walls, which was removed with some difficulty. In the spring 140 cubic yards of gravel were removed from the lock and river bed just below it.

Continuous commercial movements necessitated the maintenance of day and night forces on the lock, except during the winter months. No difficulty was experienced in passing traffic promptly and safely at all times. The only accident which occurred during the year was the sinking of a steamboat while passing upstream over the navigable pass with a tow of empty barges, and this was entirely due to the neglect of the boat's crew in observing the rule requiring navigation upstream over the dam at slow speed.

During the year the movable dam was raised and lowered as follows:

| Raised. | Lowered. | Days up. |
|---|---|---|
| July 3, 1903 | July 19, 1903 | 16 |
| July 26, 1903 | August 28, 1903 | 33 |
| September 5, 1903 | October 9, 1903 | 34 |
| October 14, 1903 | November 17, 1903 | 34 |
| November 24, 1903 | December 4, 1903 | 10 |
| May 10, 1904 | May 19, 1904 | 9 |
| June 11, 1904 | | 19 |
| Total | | 155 |

## E E 9.

## IMPROVEMENT OF ALLEGHENY RIVER, PENNSYLVANIA.

A description of the work done during the fiscal year ending June 30, 1904, will be found in the attached report of Assistant Engineer J. W. Arras.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,756.33 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | 5,000.00 |
| | 7,756.33 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 933.39 |
| July 1, 1904, balance unexpended | 6,822.94 |
| July 1, 1904, outstanding liabilities | 3.45 |
| July 1, 1904, balance available | 6,819.49 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 15,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1879 | $10,000 | August 18, 1894 | $12,500 |
| June 14, 1880 | 20,000 | June 3, 1896 | 12,500 |
| March 3, 1881 | 25,000 | March 3, 1899 | 15,000 |
| August 2, 1882 | 15,000 | August 17, 1900 (allotment) | 5,000 |
| July 5, 1884 | 35,000 | June 13, 1902 | 10,000 |
| August 5, 1886 | 30,000 | June 13, 1902 (allotment) | 5,000 |
| August 11, 1888 | 25,000 | | |
| September 19, 1890 | 20,000 | Total | 265,000 |
| July 13, 1892 | 25,000 | | |

COMMERCIAL STATISTICS.

The following is a statement of the commercial movements on the Allegheny River for the calendar year 1903. It will be observed that there is an increase of about 445,000 tons over the traffic of the previous year. This is attributed entirely to the advantages accruing to navigation on the lower Allegheny River through the operation of Herr Island dam, and is made up almost wholly of coal, gravel, and sand.

| Articles. | Tons of 2,000 pounds. | Articles. | Tons of 2,000 pounds. |
|---|---|---|---|
| Barges (new) | 7,680 | Manure | 5,341 |
| Bark | 365 | Poles, brace | 2,400 |
| Bottoms, coal boat (new) | 23,076 | Posts, check, pit, etc | 29,637 |
| Coal | 578,943 | Sand | 755,525 |
| Farm products | 2,200 | Stone | 8,738 |
| General merchandise | 870 | Tanks, iron | 150 |
| Gravel | 707,716 | Ties, railroad | 18,566 |
| Iron products and scrap | 616 | Timber | 121,488 |
| Lath | 337 | | |
| Lumber | 35,281 | Total | 2,298,429 |

Passengers, number, 37,113.

### REPORT OF MR. J. W. ARRAS, ASSISTANT ENGINEER.

The fiscal year ending June 30, 1904, was exceptional in the large number of rises and freshets and extensive ice gorges produced. The open channel improvements, consisting of low dikes and wing dams, being generally in serviceable condition at the beginning of the year and the channel comparatively free from serious obstructions, very little work was performed. Small repairs made to the existing structures were as follows:

*Hickory dam.*—Slight repairs were made to the paving.

*Red Bank dike.*—In consequence of the general overhauling of this structure during the previous year it remained in good condition except near the foot of the dike, where some scour occurred at the downstream edge, relieving five small spaces of the lower horizontal apron of its filling material and paving. Two hundred and eighty-five cubic yards of stone were procured and the damage repaired. Sixty-eight cubic yards of stone and gravel filling were placed at the upstream face of the dike opposite this break to prevent underleakage. Fifteen cubic yards of dimension stone which had been washed out of the mouth of Red Bank Creek and lodged in the channel, were also removed.

*Cowanshannock dike.*—Some disrupted paving of the pierhead of the upper dike was replaced.

*Nicholsons Island dam.*—All of the large rough stone below the middle timber wall of the structure which had been moved by ice and freshets were replaced and the interstices among them filled with smaller stone and gravel. Some displaced paving was also restored.

At Maple Island an objectionable snag was removed.

The output of ice during the last winter was the heaviest of which there is any record, and property losses to navigators along the river were considerable in consequence. However, so far as investigation has been made the injuries sustained by the public works were exceedingly slight.

Some delay was experienced in bringing the season's run of timber, new barges and boat bottoms, and other timber products past the unfinished dam at Springdale, and some losses occurred above the dam in consequence of heavy ice gorges. After the river became clear of ice no further difficulty was experienced in navigating over the dam safely.

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## E E 10.

## PRELIMINARY EXAMINATION OF BEAVER RIVER, PENNSYLVANIA, FROM THE OHIO RIVER TO THE NORTHERN END OF BEAVERFALLS BOROUGH.

[Printed in House Doc. No. 225, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a copy of a report, dated April 16, 1903, by Capt. W. L. Sibert, Corps of Engineers, upon a preliminary examination of Beaver River, Pennsylvania, from the Ohio River to the northern end of Beaverfalls Borough, with a view to slack-water navigation. This examination was called for by the river and harbor act of June 13, 1902.

The stretch of river covered by the examination is about 6 miles long. In this distance the fall is about 62 feet. Crossing it are eight bridges, two of which are railroad bridges, and none of which will give sufficient clearance in the event of the improvement of the river. There are four stationary dams used for power purposes; the minimum discharge is probably about 75 cubic feet per second—not enough for both navigation and power purposes. The aggregate population along this stretch of the river is about 35,000. There is no waterborne commerce, but a large trade is served by the railroads, there being one line on each bank.

From the natural condition of the banks of the river, which are well populated and lined with towns and manufacturing establishments, dams of very high lift could not be used without danger of flooding. It would take at least five locks and dams to pool the water from the Ohio River to the upper limits of the town. The law does not authorize an estimate of the cost of these structures to be made unless the improvement is deemed advisable; but elsewhere, under similar conditions, the same number of approximately similar locks and dams have cost in the aggregate anywhere between one and two millions of dollars. In addition to the cost of the improvement it would be necessary to destroy the water power, which is estimated by the owners to be worth $1,215,000. The bridges would also have to be raised or removed. For reasons stated in his report, Captain Sibert is of the opinion that the river is not at this time worthy of improvement, and will not be until the improvements in the Ohio to the mouth of the Beaver, and for some distance below, shall have been completed. The division engineer, Col. G. J. Lydecker, Corps of Engineers, concurs in Captain Sibert's opinion that the improvement is not advisable at the present time.

In accordance with section 14 of the river and harbor act of June 13, 1902, this report was referred for consideration and report to the Board of Engineers, organized in accordance with section 3 of that act. To the report of this Board, in third indorsement thereon, attention is respectfully invited. In the course of the investigations made by the Board, it became apparent that the improvement of the river to the upper end of Beaverfalls Borough was hoped by the people interested to be but the beginning of a project for carrying slack-water navigation to Newcastle and Sharon on the Shenango, and to Youngstown on the Mahoning. Youngstown is about 40 miles and Sharon is about 45 miles from the Ohio River. The fall from Youngstown to the Ohio is about 151 feet, of which the greater part, or about 99 feet, lies below the junction of the Mahoning and Shenango. The fall from Sharon to the junction of the Shenango and Mahoning is not far from 80 feet. It is probable, therefore, that to complete the system as hoped for some 23 locks and dams would be required to establish navigation over some 65 miles of river.

The line of the Beaver-Shenango route was formerly followed by a canal, built originally by the State of Pennsylvania and opened in 1840, between Erie Harbor and the Ohio River. This canal provided a depth of 4 feet, and carried boats of about 50 to 60 tons. It was sold by the State to a private corporation in 1843, and was managed, it is said, with profit for nearly thirty years afterwards. It was then sold and abandoned, and its bed is in some places occupied by railroad tracks. It is stated that the canal was hampered in its operation by the fact of its southern terminus being so located that during low water in the Ohio a continuation of navigation in that river was not practicable.

In its report, the Board of Engineers for Rivers and Harbors states:

> There being no navigation on this stream, it is used for other purposes, and private persons and corporations have acquired rights which must be extinguished at great cost before navigation can be established.
>
> The fall of the lower part of the Beaver River is so great that the number of dams in a slack-water system must be large in relation to the length of river to be pooled. There can be no doubt that the cost of the work from Beaverfalls to the mouth, which is the subject of the present report, would be out of proportion to the probable commercial benefits. The extension to include the lower part of the Shenango and Mahoning rivers is not before the Board for report; but it may not be amiss to state that it would evidently be a work of enormous cost as compared to the length of waterway to be improved.
>
> In view of the foregoing the Board believes that it is not desirable for the United States to undertake the improvement.

Without attempting an accurate estimate, it is probable that the entire work, which those interested hope will result from beginning the improvement in the manner contemplated in the act, will involve an expenditure of between $5,000,000 and $7,000,000. With no existing water-borne commerce, it is difficult to foretell the results of such improvement.

The improvement from Beaverfalls to the mouth, standing alone, would not be of value commensurate with the outlay. I therefore concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, that it is not desirable for the United States to undertake the improvement of Beaver River from the Ohio River to the northern end of Beaverfalls Borough, with a view to securing slack-water navigation.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### REPORT OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Pittsburg, Pa., April 16, 1903.*

GENERAL: I have the honor to submit the following report on a preliminary examination of the Beaver River from the Ohio River to the northern end of Beaverfalls Borough, with a view to slack-water navigation, as called for in river and harbor act approved June 13, 1902.

On April 8, 1903, I made a personal examination of that part of the river to be examined. The Beaver River empties into the Ohio River about 25 miles below Pittsburg. On the banks of that portion examined are the towns of Rochester, Bridgewater, New Brighton, Fallston, and Beaverfalls. In the reach of river examined are 4 stationary dams used for power purposes. Across it are 8 bridges, 2 of which are railroad bridges, and none of which would give sufficient clearance for navigation on an improved river. The minimum discharge of this river at low water is probably about 75 cubic feet per second; not enough for navigation and power purposes.

The difference in elevation between pool 6 in the Ohio River at the mouth of the Beaver River and the pool surface of a dam near the northern boundary of Beaverfalls Borough is about 62 feet. The distance by river is about 6 miles. A dam at the head of the falls, however, would give slack water for an additional distance of about 6 miles. In other words, the improvement of the reach of river under examination by a slack-water system would result in making navigable about 12 miles of the river. The head of navigation would be 9 miles from Newcastle, Pa., and 24 miles from Youngstown, Ohio, via the Shenango and Mahoning rivers.

To overcome the difference in elevation between the two pool surfaces referred to above would require at least 5 locks and dams. Possibly a lateral canal would be necessary for a mile or two of the route. This would make the cost of improvement per mile of river very great. In addition to the cost of improvement, it would be necessary to destroy water power estimated by the owners as worth $1,215,000. The water-power dams, at least three of them, could not be utilized in the improvement.

Mr. William Martin, assistant engineer, under my direction, made an examination and report upon this subject on July 29, 1902. Also on March 3, 1903, Mr. Martin made a further report, covering points designated in my letter to him of January 21, 1903. Copies of letter and of reports are inclosed.

In the valley of the Beaver, and the valleys of the Shenango and Mahoning rivers which form the Beaver, are many large and thriving, industrial towns, all of which depend on the Pittsburg district for coal and coke. The improvement of that part of the Beaver River now being reported upon would undoubtedly be of great direct benefit to the manufacturing plants in the Beaver Valley, and would also, indirectly at least, affect the price of fuel at the manufacturing plants in the Mahoning and Shenango valleys.

The improvement of the rivers in these latter valleys, at least to the towns of Newcastle, Pa., and Youngstown, Ohio, would certainly follow if the Beaver itself were improved to the extent under consideration now.

In view, however, of the fact that the improvement in the trunk stream, the Ohio River, to the mouth of the Beaver is not yet completed, and of the great cost per mile for improving the Beaver River, and of the complications that would result on account of low bridges and water-power dams, and of the limit that must be placed upon the total appropriations made in river and harbor bills, it is my opinion that while the improvement of the Beaver River would result in increasing the manufacturing facilities of the Beaver Valley, it is not at this time worthy of improvement and will not be until the improvements in the Ohio to the mouth of the Beaver and for some distance below shall have been completed, thus causing the improved Beaver River to form a part of a reliable waterway system for the transportation of interstate commerce.

Very respectfully, your obedient servant,

WM. L. SIBERT,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, April 20, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in Captain Sibert's opinion that the improvement is not advisable at present.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 25, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

Additional information has been called for, if available.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., June 12, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer upon a preliminary examination of Beaver River from the Ohio River to the northern end of Beaverfalls Borough, with a view to slack-water navigation, the indorsement of the division engineer thereon, and all other data at hand. On June 9, 1903, a committee of the Board held a public hearing at Beaver, Pa., at which interested parties appeared to advocate the improvement. The committee also made a personal inspection of the river between Beaverfalls and its mouth.

Beaver River empties into the Ohio River 25 miles below Pittsburg, Pa. Its discharge at low water is about 75 cubic feet per second. On the banks of the reach under consideration are located the towns of Rochester, Bridgewater, Fallston, Beaverfalls, and Beaver, having an aggregate population of about 35,000. On the section of river covered by the preliminary examination are four fixed dams used for power purposes. The stream is crossed by eight bridges (two railroad), most if not all of which would require changes in the event of improvement for navigation. The fall from Beaverfalls to the Ohio River is 62 feet, the distance being 6 miles.

The object of the desired improvement is not primarily the water shipment of articles manufactured in the Beaver River Valley, but rather the transportation to the mills and factories of materials required by them. It was stated at the public hearing that the real motive in seeking the improvement of Beaver River is ultimately to carry slack-water navigation to Newcastle and Sharon, on the Shenango, and to Youngstown, on the Mahoning, which rivers unite to form the Beaver River at a point 20 miles above its mouth. The fall from Newcastle to the Ohio is 99 feet, and from Youngstown to the Ohio the fall is 151 feet. A canal built by the State many years ago, parallel and adjacent to Beaver River, was abandoned about 1872.

There being no navigation on this stream, it is used for other purposes, and private persons and corporations have acquired rights which must be extinguished at great cost before navigation can be established.

The fall of the lower part of the Beaver River is so great that the number of dams in a slack-water system must be large in relation to the length of river to be pooled. There can be no doubt that the cost of the work from Beaverfalls to the mouth, which is the subject of the present report, would be out of proportion to the probable commercial benefits. The extension to include the lower part of the Shenango and Mahoning rivers is not before the Board for report, but it may not be amiss to state that it would evidently be a work of enormous cost as compared to the length of waterway to be improved.

In view of the foregoing, the Board believes that it is not desirable for the United States to undertake the improvement of Beaver River from the Ohio River to the northern end of Beaverfalls Borough, with a view to slack-water navigation.

For the Board:

Chas. J. Allen,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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### REPORT OF MR. WILLIAM MARTIN, ASSISTANT ENGINEER.

Bellevue, Pa., *July 29, 1902.*

Captain: I have the honor to submit the following report, in compliance with your verbal instructions, and with a provision of section 14 of the river and harbor act of June 13, 1902, to make a preliminary examination of the Beaver River from the Ohio River to the northern end of Beaverfalls Borough, concerning the commercial importance and the advisability of its improvement by the National Government.

The Beaver River, within the bounds stated, lies wholly within Beaver County, and is about 6 miles long and from 350 to 400 feet wide. The mouth of the river where it joins the Ohio River is 25 miles below Pittsburg, Pa., and lies in pool numbered six of the Ohio River slack-water system. Bordering on its banks are the towns of Rochester, Bridgewater, New Brighton, Fallston, and Beaverfalls, while immediately above the borough line are situated the towns of College Hill and Eastvale. These towns, with the exception of Eastvale, are devoted chiefly to iron and steel manufacturing, and are included in what is known as the Pittsburg district.

This stretch of river is paralleled by and is adjacent to the remains of the old State canal, the use of which as an artery of transportation was abandoned about the year 1872. The river is spanned by 2 railroad bridges and 6 highway bridges. It is also slackwatered by 4 dams, the same dams (with the exception of the upper one, which has been rebuilt) as existed and were used by the old State canal. These dams are in fairly good condition. The upper dam, which is quite close to the borough line, forms a pool about 7 miles long, bordering on which are many stone quarries, whose output in 1901 is given as 350,000 tons.

The aggregate population of the towns mentioned, according to the last census, is 35,000, and is rapidly increasing, due to new manufactories locating in this section. Seven thousand men are employed in the various mills.

The following is a statement of the commercial statistics compiled for the year 1901:

| | Incoming freight. | Outgoing freight. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Beaverfalls | 192,501 | 144,750 |
| New Brighton | 98,129 | 180,658 |
| Fallston | 13,500 | 42,000 |
| College Hill | 23,640 | 376,900 |
| Total | 327,770 | 744,308 |

In the foregoing tonnage, fuel amounts to 134,793 tons; stone from the quarries, 350,000 tons; brick, 150,000 tons; queensware, glassware, axes, shovels, files, stoves, saws, machinery, and other finished products of steel amount to 437,285 tons, making a total of 1,072,078 tons.

The stone industry is increasing very rapidly and gives promise of great development within the next few years.

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Very respectfully, your obedient servant,

William Martin,
*Assistant Engineer.*

Capt. Wm. L. Sibert,
*Corps of Engineers, U. S. A.*

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### LETTER OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS.

Engineer Office, United States Army,
*Pittsburg, Pa., January 21, 1903.*

Sir: In connection with preliminary examination of Beaver River, I wish you would ascertain and report the number of bridges crossing that portion of the river ordered examined, giving the lengths of spans and clear heights that these bridges will have above an improved river. I wish you would also investigate and report upon the question of water power at present in use on the Beaver River, whether the same would be destroyed by canalization of the stream, and if so, an approximate estimate of the damages ensuing. Also report on whether the low-water supply of the Beaver River is sufficient to furnish water for navigation purposes, and for the water powers at present established on said stream.

Please attend to this as soon as practicable.

Very respectfully,

Wm. L. Sibert,
*Captain, Corps of Engineers.*

Mr. Wm. Martin,
*Assistant Engineer.*

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### REPORT OF MR. WILLIAM MARTIN, ASSISTANT ENGINEER.

Bellevue, Pa., *March 3, 1903.*

Captain: In compliance with your instructions, contained in letter of January 21, 1903, to make a preliminary examination of the Beaver River from the Ohio River to the upper corporate limits of Beaverfalls, with a view to determine the practica-

## E E 11.

## PRELIMINARY EXAMINATION OF CHEAT RIVER, WEST VIRGINIA.

[Printed in House Doc. No. 248, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith a report, dated January 21, 1903, by Capt. W. L. Sibert, Corps of Engineers, on preliminary examination of Cheat River, West Virginia, ordered by the river and harbor act of June 13, 1902. In Captain Sibert's opinion, concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, the locality is not worthy of improvement by the General Government at the present time.

The Board of Engineers for Rivers and Harbors has reviewed this report, in accordance with the provisions of sections 3 and 14 of the above-mentioned act, and submits report in indorsement of July 31, 1903, thereon. A statement of the objects and results obtained by operations heretofore carried on by the United States on this stream is given in its report, and for reasons stated therein the Board is of opinion that it is not advisable at the present time for the United States to undertake this improvement.

I concur in this opinion.

Very respectfully, your obedient servant.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### REPORT OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Pittsburg, Pa., January 21, 1903.*

GENERAL: I have the honor to submit the following report on a preliminary examination of the Cheat River, West Virginia, as called for in river and harbor act approved June 13, 1902:

On July 25 and 26, 1902, I made personal examination of that portion of the river lying between its mouth and the point where the river emerges from its cut through Laurel Ridge.

A preliminary examination was made of this stream by the late Lieut. Col. William E. Merrill, Corps of Engineers, in 1889. His report on this examination is printed in the Annual Report of the Chief of Engineers for 1889, pages 1905 to 1909, inclusive. The details of the natural physical conditions of this stream are enumerated in this report, and it is not deemed necessary to repeat them.

The Cheat River empties into the Monongahela River about 1½ miles north of the southern boundary of the State of Pennsylvania, and is one of the principal tributaries of the latter river, at least so far as water supply is concerned. The total length of the Cheat River is about 140 miles. The upper 90 miles of the stream has a gentle slope and is suitable for the running of loose logs; the next 40 miles coming down the river is rough, full of bowlders, and is difficult to navigate with loose logs. The 10 miles next the mouth, after the river emerges from its cut through Laurel Hill, is of approximately uniform slope and is adapted in its present condition to running timber at suitable stages of water.

The project recommended by the late Lieut. Col. William E. Merrill in preliminary examination referred to above was adopted by Congress. All of the money estimated was appropriated and expended. The object of the improvement was to make the river navigable for loose logs.

It is not thought by this office that it is practicable to make the river navigable for anything but loose logs above a point about 10 miles above its mouth. The fall in these 10 miles of river is about 3 feet per mile, and the only practicable way to improve this stretch of river for any navigation except that of floating timber would be by locks and dams, the cost of which, due to the excessive fall, would not in the opinion of this office be commensurate with the commerce that would follow the improvement of the stream. The commerce would be local and the improved river would simply be a means by which property holders along that particular stretch could transport their commerce either to the railroad at Cheat Haven or Point Marion, or to the Monongahela River.

While it is true that the 10 miles of river in question is an undeveloped section in so far as its mineral resources are concerned, and while it is true that this section is rich in minerals, it is not materially different from all the surrounding country.

It is therefore the opinion of this office that the Cheat River, West Virginia, is not worthy of improvement by the General Government at the present time.

The following is the commerce transported via the Cheat River in 1902, so far as obtained:

| | Tons. |
|---|---|
| Log rafts | 1,703 |
| Pole rafts | 778 |
| Pile rafts | 740 |

The natural resources of this section are timber, sandstone, limestone, fire clays, coking coal, etc.

Very respectfully, your obedient servant,

Wm. L. Sibert,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, January 22, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

I concur in Captain Sibert's opinion respecting the improvement of this river by the Government at present.

G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

Office Chief of Engineers, U. S. Army,
*February 5, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 31, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of Cheat River, West Virginia, the indorsement of the division engineer thereon, and other data available.

The river and harbor act of 1888 directed a preliminary examination of Cheat River. The district officer's report will be found on page 1905, Annual Report of the Chief of Engineers for 1889. The project therein suggested is to blast and remove rock, and thus make a channel navigable by loose logs. The estimated cost of the work was $13,000, and operations were to be confined to the 30 miles below Rowlesburg. This sum was appropriated by the river and harbor act of 1890, and had been expended by June 30, 1902. The effect of the improvement upon the commerce of the stream was not great and was temporary merely. The nature of the stream and of the work done is such that any improvement effected would be permanent; yet the quantity of logs brought down the river in 1902 was less than in several years before the improvement was made.

Accordingly no further improvement of this stream in aid of log navigation is considered advisable.

To improve the stream for navigation by boats would be very costly. Even in the lower 10 miles, which is the portion of the stream which would lend itself most readily to improvement, the slope is such that the only practicable means of improvement would be locks and dams. The cost of such work would be wholly out of proportion to the probable commercial benefits.

The Board concurs in the opinion of the district officer and the division engineer that it is not advisable at this time for the United States to undertake the improvement of Cheat River, West Virginia.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## E E 12.

## PRELIMINARY EXAMINATION OF LOCKS AND DAMS 1, 3, 4, AND 5, MONONGAHELA RIVER, PENNSYLVANIA.

[Printed in House Doc. No. 209, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 5, 1903.*

SIR: I have the honor to submit herewith report, dated August 5, 1902, and supplemental report, dated August 12, 1903, by Capt. W. L. Sibert, Corps of Engineers, on preliminary examination of Monongahela River, Locks and Dams Nos. 1, 3, 4, and 5, ordered by the river and harbor act approved June 13, 1902.

These locks and dams were built many years ago by the Monongahela Navigation Company, from which they were acquired by the United States by purchase in 1897. Nos. 1, 3, and 4 are double locks, and No. 5 is a single one; they are in bad repair and are inadequate in capacity for the present commerce of the river. Captain Sibert states specifically in regard to each of the locks and dams referred to that it is worthy of improvement by the United States, and this opinion is concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers.

The plan of improvement suggested by Captain Sibert contemplates the remodeling of existing locks and dams numbered 1 and 4 and the construction in new locations of new structures to replace existing locks and dams numbered 3 and 5. In each case double locks 56 feet wide and 360 feet long in the clear are to be provided. He estimates the cost at $2,118,791. The rebuilding of Lock and Dam No. 5, the purchase of necessary land for the rebuilding of Lock and Dam No. 3, and the purchase of the necessary land for remodeling Lock No. 1 are considered by him the most urgent items of the estimate.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, in pursuance of the provisions of sections 3 and 14 of the above-mentioned act, and in its report of October 2, 1903, the Board states:

> The Board is of opinion that, considering the needs of present and prospective commerce, the expenditure of the sum above mentioned is justified, and that it is desirable for the United States to undertake this improvement. The Board is greatly impressed with the urgency of the proposed work, especially at Locks 5 and 3. To enable the improvement to be carried out as expeditiously as it deserves to be, and as economically as possible, it is recommended that in the next river and harbor act an appropriation of $250,000 be made, and that the Secretary of War be authorized to enter into contracts to complete the work, at a total cost not exceeding $2,118,791.

The opinion of the Board is concurred in by me.

Since the date of the report of the Board of Engineers for Rivers and Harbors a report has been received from the district officer to the effect that Lock No. 3 has developed alarming signs of weakness and can be kept serviceable for no greater length of time than will be required for the construction of a new lock.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Pittsburg, Pa., August 5, 1902.*

GENERAL: I have the honor to submit the following report on the preliminary examination called for as follows in the river and harbor act of June 13, 1902: "Monongahela River, Locks and Dams One, Three, Four, and Five."

*Lock No. 1, Monongahela River.*—This lock is 1½ miles above the mouth of the river. It has two parallel chambers; the outside chamber is 50 feet wide and 159 feet long in the clear, and was constructed in 1840; the inside chamber is 56 feet wide and 250.3 feet long in the clear, and was constructed in 1848. The number of lockages at this lock during the fiscal year ending June 30, 1902, was 18,911; the number of boats, barges, etc., passed was 40,339; the freight tonnage was 4,786,819.

Since 1848 nothing has been done to increase the capacity of this lock; it is inadequate for the traffic. When both chambers are in good working order the demands of navigation can be met, but when repairs are necessary to either chamber, river commerce is delayed. This lock is in Pittsburg Harbor, and the demands upon it will continually increase. The traffic through it during the fiscal year ending June 30, 1902, was 357,651 tons less than that through it in the fiscal year ending June 30, 1901. This decrease was due to the consumption of coal by manufacturing plants in the first, second, and third pools, and to the stage of river causing the harboring of coal in the first and second pools awaiting a shipping stage in the Ohio River.

The small chamber is not long enough to pass a coal boat, and the large chamber, while wide enough for two coal boats abreast, is not long enough for more than one length of coal boat. Coal boats are 26 feet wide and from 170 to 180 feet long. The average pool tow in the Monongahela River consists of 3 coal boats and the towboat. The capacity of the lock chambers should be such as to lock this tow at one locking.

It is the opinion of this office that Lock and Dam No. 1, Monongahela River, is worthy of improvement by the United States, and it is respectfully recommended that a survey be made and a project prepared for the necessary improvement.

*Lock No. 3, Monongahela River.*—This lock is 25 miles above the mouth. It has two parallel chambers; the outside chamber is 50 feet wide and 159 feet long in the clear, and was completed in 1844; the inside chamber is 56 feet wide and 276 feet long in the clear, and was completed in 1883. During the fiscal year ending June 30, 1902, the number of lockages at this lock was 16,729; the number of boats, barges, etc., passed was 50,275; the freight tonnage was 7,273,291. The freight tonnage for the fiscal year ending June 30, 1902, was 1,107,129 more than that for the fiscal year ending June 30, 1901.

The small chamber is too short to pass an ordinary coal boat, and the large chamber is too short to pass more than one length of the ordinary coal boat. The lock is crowded beyond its capacity under present conditions. When repairs are necessary to either chamber, business is restricted and seriously interfered with.

It is the opinion of this office that this lock and dam is worthy of improvement by the United States, and it is recommended that a survey be made and project prepared for the necessary improvement.

*Lock No. 4, Monongahela River.*—This lock is 41 miles above the mouth of the river. It has two parallel chambers. The outside chamber was completed in 1844. It is 50 feet wide and 159 feet long in the clear. The inside chamber is 56 feet wide and 225 feet long in the clear, and was completed in 1886.

Coal in the lower pools of the Monongahela River is fast being exhausted, and mines are being opened in the pools above Lock No. 5. The output of these new mines must pass through Lock No. 4. This, in addition to the commerce already existing, will, in the near future, crowd the lock beyond its capacity.

The ordinary coal boat can not be passed through the small chamber of this lock, and only one length of coal boat can be passed through the larger chamber.

During the fiscal year ending June 30, 1902, the number of lockages at this lock was 15,616; the number of boats, barges, etc., passed was 43,064; freight tonnage was 5,767,497. The freight tonnage through this lock for the fiscal year ending June 30, 1902, was 657,284 tons greater than that through it during the fiscal year ending June 30, 1901.

It is the opinion of this office that this lock and dam is worthy of improvement by the United States. It is respectfully recommended that a survey be made and a project prepared for the necessary improvement.

*Lock No. 5, Monongahela River.*—This lock is 59 miles above the mouth; it has one chamber 50 feet wide and 165 feet long in the clear, and was completed in 1856. It is possible, by taking advantage of the angle between the gates and by properly maneuvering a coal boat, to pass the same through the lock. The depth of water on its floor and sills, however, makes it inadequate for the passage of the ordinary coal traffic through it. The available depth of water through the lock, with the flashboards up on Dam No. 4, is about 4.6 feet at pool stage. Coal boats draw from 8 to 8.5 feet; coal barges from 6 to 6.5 feet.

This lock is now a practical bar to the proper development of the mineral resources of that portion of the Monongahela River Valley above it. Four large coal properties are, however, being opened up above it, and other developments will quickly follow proper locking facilities through it.

Freight tonnage through this lock during the fiscal year ending June 30, 1902, was 434,515, the same being 179,847 tons more than that during fiscal year ending June 30, 1901.

In the opinion of this office this lock is worthy of improvement, and it is respectfully recommended that a survey be made and a project prepared.

It is estimated that a survey of Locks and Dams 1, 3, 4, and 5 can be made, and projects prepared for improving the same, at a cost of $1,500.

Very respectfully, your obedient servant,

Wm. L. Sibert,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, August 6, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the opinions and recommendations contained in the within report.

G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 26, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By order of the Acting Chief of Engineers:

H. F. HODGES,
*Major, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 2, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report on a preliminary examination of the "Monongahela River, Locks and Dams One, Three, Four and Five," the indorsement of the division engineer thereon, and the district officer's accompanying report of a survey made in extension of the preliminary examination.

On September 27, 1903, a committee of the Board made an inspection of the river from Pittsburg to Lock and Dam No. 5, inclusive.

There are 15 locks and dams constructed or constructing on the Monongahela River. The first lower four locks are double. The first seven locks and dams were built by the Monongahela Navigation Company. The property and rights of this company were acquired by the United States in 1897 for $3,761,615.46.

The project for the construction of Locks and Dams 8 and 9 was adopted in 1872 and completed in 1889, at a cost of $436,900.

The project for the construction of Locks and Dams 10 to 15 was adopted February 3, 1897. The estimated cost of the work is $1,200,000.

The river and harbor act of June 13, 1902, appropriated $200,000 for the rebuilding of Lock and Dam No. 2, and authorized the making of contracts for the completion of the work at a total cost not to exceed $655,961.

In the case of Locks and Dams 1, 3, 4, and 5, the subject of the within report, the district officer proposes such work as is necessary to provide a suitable low-water channel and double locks each 56 feet wide and 360 feet long in the clear. At Nos. 1 and 4 the dams are to be repaired and as much use as possible made of existing lock masonry. At Nos. 3 and 5 it is found advisable to construct new locks and dams. The cost of the proposed work is estimated by the district officer at $2,118,791.

The commerce of the Monongahela River for the year ending June 30, 1903, is reported by the district officer to have been more than 11,000,000 tons. The greater part of the coal shipped down the Ohio River comes out of the Monongahela, and a large and increasing proportion of that used by the furnaces and mills which line the banks of the lower pools of the Monongahela and Allegheny rivers is carried to them by the Monongahela route. The price of fuel in the greatest steel-making center in the world, throughout the Ohio and lower Mississippi valleys, and upon the Great Lakes, is affected to a considerable extent by the fact of the navigability of the Monongahela. The approaching completion of Locks 10 to 15 will add to the importance of the lower stretch of river, which is that under present consideration.

The district officer points out that the present locks are inadequate to handle the growing commerce of this stretch of river. Moreover Locks 3 and 5 are in dangerous condition, and the failure of either one, especially of Lock 3, would seriously cripple the traffic of the river.

The Board is of opinion that, considering the needs of present and prospective commerce, the expenditure of the sum above mentioned is justified, and that it is desirable for the United States to undertake this improvement. The Board is greatly impressed with the urgency of the proposed work, especially at Locks 5 and 3. To enable the improvement to be carried out as expeditiously as it deserves to be, and as economically as possible, it is recommended that in the next river and harbor act an appropriation of $250,000 be made, and that the Secretary of War be authorized to enter into contracts to complete the work, at a total cost not exceeding $2,118,791.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of Board.*

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## SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION.

UNITED STATES ENGINEER OFFICE,
*Pittsburg, Pa., August 12, 1903.*

GENERAL: In compliance with instructions from your office, I have the honor to submit herewith a report on the survey of Locks and Dams Nos. 1, 3, 4, and 5, Monongahela River, as provided for in section 14 of the river and harbor act approved June 13, 1902.

Locks 1, 3, and 4 have each two chambers. Lock 5 has only one chamber.

*Present condition of Lock and Dam No. 1.*—The smaller or outside chamber of this lock, with available length of 159 feet and width of 56 feet, was completed in 1840. The inside chamber, with available length of 216 feet and width of 56 feet, was built in 1848, since which date nothing has been done to increase the capacity of either chamber of this lock. The lock proper and a portion of the dam rest on solid rock. The masonry of the lock is in fair condition. The dam, however, being an old timber dam, is in need of extensive repairs, especially repairs that will reduce the leakage through it to a minimum.

*Present condition of Lock and Dam No. 3.*—The dimensions of the chambers of this lock are the same as those stated for No. 1. The smaller chamber was completed in 1844 and the larger one in 1883. Both the lock and the dam are founded on gravel. The foundation of the lock is a single layer of timber placed transversely on the gravel, over which are spiked two courses of plank. The floor of the large chamber has been forced up in places as much as 9 inches by pressure from beneath, and piles have been driven through and fastened to the floor in order to prevent any further upheaval. It was impracticable, however, to lower the floor to its original level. The scour outside the river wall below the dam has made it difficult to prevent that wall from being destroyed. The space, however, has at several times been filled with stone-filled cribs, and the settlement of the river wall has not increased perceptibly for several years. In the construction of the larger chamber in 1883 a poor quality of cement was used, a cement that has continued to swell and expand from the date of completion of the chamber until now. The walls of this chamber were originally built with a batter from the pit of 7 inches at the top. The distortion of the walls, due to the expansion of the cement, caused them to lean inward toward the chamber, in places as much as 11 inches, making the total movement as much as 18 inches. The resultant overhanging portions of the wall were cut away in order to preserve the necessary width, and the masonry was tied together by tie-rods and bands to prevent it from falling apart. The dam at this site is an old timber dam and is in need of extensive repairs, especially such repairs as will decrease the leakage.

*Present condition of Lock and Dam No. 4.*—The small chamber of this lock has the same dimensions as the small chamber at No. 3, and was completed in 1844. The large chamber, with available dimensions of 225 feet by 56 feet, was completed in 1886. The lock is founded on very compact gravel. The scour below the dam, however, threatened in years past the river wall of the small chamber, which was made secure by means of cribs. The wall had, however, leaned outward about its center, at one point 3 feet at the top. The inside face of this wall was repaired with timber and concrete so as to practically reproduce the old chamber face line. The lower end of the land wall of the small chamber was undermined so that in 1874 it fell down for a length of about 30 feet. This was due to the destruction of the upper gate by a steamer entering the chamber at full speed. The larger, or inside, chamber was founded deeper than the outside chamber, and is of splendid stone and in good condition. The dam at this site is an old timber dam, and is in need of extensive repairs.

*Present condition of Lock and Dam No. 5.*—This lock was completed in 1856. Its original dimensions were 159 feet by 50 feet. Its length, however, has since been increased 6 feet by shifting the position of the quoins of the gates. At pool-full stage there are only 4 feet of water on the lower sill. The floor of the lock, near the upper end of the chamber, has been lifted by upward pressure about a foot, so that there is really only an available depth of approximately 3 feet in the chamber of this lock at pool stage, with no flashboards on Dam No. 4. However, this depth can, by these flashboards, be increased to 5 feet for a portion of the year. In addition to the difficulties experienced by the coal shippers at Lock No. 5 proper, the river for a mile below the lock is too shallow for economical shipment of coal. When this lock was planned in 1856 it was not anticipated that coal would ever be shipped from points above the fourth pool, and a packet navigation was all that was provided for in fixing the depth of water on the sill. Since that time a great portion of the coal in the pool below has been mined, and several large coal companies are now opening tipples on the Monongahela River above this lock. These operators, however, are greatly hampered by the shortness of the period during which they can carry fully laden craft from above Lock 5 to the lower markets. A portion of the river wall of this lock was undermined, in its earlier history, and fell, due to a breach in the dam. The present wall was built on the débris of the old one, and cribs were sunk outside to prevent similar erosion in the future, but the work of reconstruction was not of such character as to warrant much confidence in its stability. Cracks have appeared recently in the river wall. The wall has been grouted, however, and other measures taken to insure its safety.

The commerce on the Monongahela River for the fiscal year ending June 30, 1903, was 11,369,814 tons. The average number of lockages per year for the last five fiscal years through the following locks was:

| | |
|---|---|
| No. 1 | 21,673 |
| No. 3 | 17,555 |
| No. 4 | 15,829 |
| No. 5 | 5,163 |

The survey and records of the office show that none of the locks reported upon herein have sufficient capacity to meet the present demands of commerce. By operating them night and day, with no breakages, commerce is kept moving, but an accident, and accidents must occur, always causes serious delay. Lock No. 5, having only one chamber and that a small one, and with insufficient depth on the sills, is now a great barrier to the proper development of the coal fields above it, but in anticipation of its early reconstruction large coal properties are being opened above it.

After careful study of the sizes of the various crafts plying the Monongahela River, and after consultation with men engaged in navigation, I am of the opinion that Locks Nos. 1, 3, 4, and 5 should each have two chambers, each chamber 56 feet wide and 360 feet long in the clear. In rebuilding or remodeling such structures so as to meet present conditions, the future demands upon the resulting structures within their life should be anticipated and, considering the remarkable extension of manufacturing industries along the Monongahela River within the last few years, I feel that locks with chambers as proposed above will be fully taxed during their life.

The demand for increased pool depths over those originally designed has been met in the past in an unsatisfactory way by flashboards. These boards are taken off by each rise and it is impracticable to replace them until the river has fallen to such an extent as to reduce the depth available with the boards on. This results in a serious interference with commerce, the boats not being able to rely upon a constant least depth, and in rebuilding or remodeling these locks and dams it is thought that a reliable movable top 3 feet high should be placed upon the dams

## PROPOSED PROJECT AND ESTIMATE.

*Lock and Dam No. 1.*—This lock being founded on rock, and the larger chamber being of the width thought to be best suited to the needs of the stream, it is proposed to retain the larger chamber and extend the same downstream so as to give in it a length of 360 feet in the clear, and to construct on the outside of it a new chamber of the same dimensions, and to purchase sufficient property below for the construction of a suitable entrance to the new lock. It is proposed to place a new concrete top on the present dam and to construct in the same a movable weir about 3 feet high of the drum or other approved

| | |
|---|---|
| Stone for cribs and pile work of dam | $26,397 |
| Cost of erection of five new lock gates, including sills and quoins, valves in lock gates, anchorage, etc | 35,000 |
| New machinery for operating five lock gates, including all necessary buildings at lock | 25,000 |
| Filling behind land wall and in front of dam, paving of slopes and terrepleins | 14,000 |
| Concrete work on dam and low iron movable top on same, 600 feet | 69,480 |
| Concrete guard and guide walls above and below lock | 76,105 |
| Dam abutment, concrete | 6,000 |
| Dredging approaches, 24,000 cubic yards, at 25 cents | 6,000 |
| | 626,122 |
| Contingencies, 5 per cent | 31,306 |
| Total | 657,428 |

*Summary of estimates.*

| | |
|---|---|
| Lock and Dam No. 1 | $443,184 |
| Lock and Dam No. 3 | 589,196 |
| Lock and Dam No. 4 | 428,983 |
| Lock and Dam No. 5 | 657,428 |
| Total | 2,118,791 |

In view of the immense commerce already in existence on this river, and of the fact that the present structures are hardly able to accommodate it under the most favorable conditions, I am of the opinion that Locks Nos. 1, 3, 4, and 5, Monongahela River, are worthy of improvement by the General Government. It is considered that the rebuilding of Lock and Dam No. 5, the purchase of the necessary land for the rebuilding of Lock and Dam No. 3, and the purchase of the necessary land for remodeling Lock No. 1, are the most urgent items of the estimate. It is thought that with care Lock No. 3 can be kept serviceable for four years, and that Lock No. 4 can be made to meet the demands of commerce for the same period, barring unlooked-for accidents.

Very respectfully, your obedient servant.

WM. L. SIBERT,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, August 20, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring with the views expressed by Captain Sibert in the within report.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

## E E 13.

## MODIFICATION OF HARBOR LINES ON THE RIGHT BANK OF THE MONONGAHELA RIVER AT McKEESPORT, PENNSYLVANIA.

National Tube Company,
National Department,
*McKeesport, Pa., September 15, 1903.*

Dear Sir: I am inclosing under separate cover a blueprint[a] showing the proposed new mills which the National Tube Company desire to build at McKeesport, and also blueprint[a] showing the modification of the United States harbor line along the southern shore of the Monongahela River, in front of the property of the National Tube Company, which we ask you to consider. You will notice that we have completely filled the available territory with the proposed new mills to such an extent that we have not sufficient track room to handle our internal tracks properly with the track system, as shown on this print. We find that through tracks on and near the river bank, so as to permit of moving material from the iron mills near Riverton street to the rolling mills without being interrupted by local railroad work in the steel works and furnace yards, is an imperative necessity. Also, under the conditions, as shown on the print, we will be compelled to lay our large water mains under the railroad tracks, which is not good engineering.

Referring to the print showing the United States harbor line, we respectfully ask you to consider the following modification:

The yellow line shown on this print marks the location of the new harbor line which we ask you to locate in place of the present harbor line, which is shown in white. This would cut off some 25 or 30 feet at the narrowest point of the river, and moves the harbor line riverward lower down where the river is broader. We would propose to build a wall of cupola cinder, cemented with hot furnace slag, along the river front, making the wall with a slope of 1 foot horizontal to 3 feet vertical.

This change in the harbor line, if made, would permit us to put in our track system in fairly good shape, and would not, we trust, make the river conditions worse, but, on the contrary, better. We would agree to remove the material which is outside of the yellow line within two years from date of receipt of permission to utilize the space on the land side of the yellow line.

As we desire to begin work on the intake of our new pumping plant at once, an early consideration of this matter would be very much appreciated.

Yours, respectfully,
Wm. B. Schiller,
*President.*

Capt. W. L. Sibert,
*Corps of Engineers.*

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[a] Not printed.

## LETTER OF THE CHIEF OF ENGINEERS.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, April 18, 1904.*

SIR: The Pittsburgh Coal Exchange submitted request under date of June 27, 1902, for extension of harbor lines at Pittsburg, Pa., from Davis Island dam so as to include pools Nos. 2 and 3 on the Ohio River.

It appearing from report of July 9, 1902, by the local officer, Capt. Wm. L. Sibert, Corps of Engineers, * * * that the establishment of such lines by the United States would be desirable, he was authorized to take up the consideration of the question with a view to presenting for action by the Department such lines as, in his judgment, would best subserve the various interests involved. His further report was submitted under date of February 23, 1904.

This subject has received very careful consideration at the hands of Captain Sibert, who has made special surveys, held a public hearing, and, so far as in his opinion could consistently be done, made alterations to meet the demands of interested riparian owners in the lines originally proposed by him.

Numerous protests against the proposed lines remain unsatisfied, however, the grounds for such opposition being briefly stated as follows:

(a) By act of Congress approved June 12, 1876, the residents and property holders of Neville Township, Pa., were authorized and empowered to close the channel of the Ohio River on the south side of Neville Island, commonly known as the "back channel," by the construction of an embankment or causeway from the head of said island to the southern shore of the river.

(b) This embankment or causeway was never built, and, it appearing that its construction might prove rather objectionable than otherwise, the law authorizing such construction was repealed by section 8 of the river and harbor act approved June 13, 1902.

(c) In the meantime certain private parties had secured from the State of Pennsylvania, under authority of a State statute enacted in 1897, in relation to patenting lands lying within and along navigable rivers, patents covering the entire river bed comprised in said back channel at Neville Island.

Certain of the contestants contend that no harbor lines at all should be established on this back channel, arguing that this channel is no longer a navigable water of the United States, it having been abandoned as such when the act of 1876 was passed which authorized the construction of the causeway.

Other protestants base their contention on the ground that the channelway through the back channel as proposed by Captain Sibert is too wide and that a less width would be sufficient.

This latter point is discussed at length in Captain Sibert's report of February 23, 1904, herewith, where it is shown that the width of channelway of 560 feet adopted by him for practically the entire length of the back channel is in itself a compromise and less than the calculated width necessary. The effect of the uncontrolled encroachment by riparian owners into the bed of a stream considered unnavigable is well illustrated by the disastrous flood in the Kaw River in

1903 and the resulting efforts to remedy these encroachments even at an enormous cost.

With reference to the first contention, Captain Sibert takes the position that, the causeway never having been built, the back channel has always remained subject to the general laws governing navigation.

This position is conformable to a decision given March 31, 1900, by the Judge-Advocate-General in a bridge case, in which the jurisdiction of the United States was likewise at issue. This decision is as follows:

> I do not think that this act [of June 12, 1876] should be construed as, in itself, taking this channel out of the list of navigable waters of the United States, but as giving the consent of Congress to the closing of the channel by the beneficiaries of the act as provided therein. So long as the authority given in the act is not exercised, it is believed that the channel is legally a navigable water of the United States, and comes within the purview of the legislation of Congress made for the protection of such waters.

In this connection I refer also to the opinion of the supreme court of the State of Pennsylvania, in Bailey *v.* Miltenberger (31 State Reports, Casey 7, pp. 37–43), to the effect that the absolute ownership of land adjoining a navigable stream extends only to high-water mark; below that, ownership of the soil will not authorize such use of it as will interfere with the use of the stream as a highway.

Furthermore, the protests based on patents issued by the State of Pennsylvania covering the bed of the back channel at Neville Island are founded on the assumption that the United States, in authorizing the construction of the causeway, abandoned said back channel as a navigable waterway. This could not be the fact. The Government, when it builds a dam or allows one to be built, does not abandon the stream as a navigable waterway. Even had the causeway been built, the stream might have remained navigable both above and below the obstruction, and in that case would have remained under the control of the War Department for navigation purposes. Indeed, the part below the obstruction might conceivably have formed a most valuable harbor. The causeway not having been built, the back channel did remain navigable, and is under such control.

Concurring in the views of the local officer that the back channel of the Ohio River is subject to the provisions of law in regard to navigable waters, and that in both the main and back channels of the river between Davis Island dam and Dam No. 3, near Osborn, Pa., harbor lines should be established for the preservation and protection of navigable waters of the United States, I recommend that the lines selected, which are delineated and described on the 10 tracings[a] herewith, be approved, and that the Secretary of War place his approval on the title and index sheet, which has been prepared for his signature.

In this connection attention is invited to requests from attorneys for certain parties opposed to this proposed action for a hearing before the Secretary of War in this case, which requests are returned to the Secretary by separate indorsement of this date.

Very respectfully, your obedient servant,

A. MACKENZIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. WM. H. TAFT,
*Secretary of War.*

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[a] Not printed.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
*Washington, D. C., April 25, 1904.*

Respectfully returned to the Secretary of War, inviting attention to the statement of the case by the Chief of Engineers in within letter, dated April 18, 1904. It is understood that the views of this office are desired as to whether there is any legal objection to the approval of the harbor lines recommended by the Chief of Engineers for approval, particularly with reference to the effect of the act of June 12, 1876 (19 Stat. L., 58), on the authority to establish lines for the back channel at Neville Island. The act in question provided as follows:

> That the residents and property owners of Neville Township, county of Allegheny and State of Pennsylvania, be, and they are hereby, authorized and empowered to close the channel of the Ohio River on the south side of Neville Island, in said township, by the construction of an embankment or causeway from the head of said island to the southern shore of said river: *Provided, however*, That the Government of the United States shall not be liable for any expenses incurred in the performance of said work, or by reason thereof.

In my opinion, dated March 31, 1900, on the question whether the effect of this act was to take the channel out of the list of navigable waters of the United States, this office said:

> I do not think that this act should be construed as in itself taking this channel out of the list of navigable waters of the United States, but as giving the consent of Congress to the closing of the channel by the beneficiaries of the act as provided therein. So long as the authority given in the act is not exercised it is believed that the channel is legally a navigable water of the United States, and comes within the purview of the legislation of Congress made for the protection of such waters.

The embankment or causeway authorized by said act was never built; and, it appearing that its construction might prove objectionable to the interests of navigation, the act was repealed by section 8 of the river and harbor act, approved June 13, 1902. It is stated that certain private parties had secured, in the meantime, from the State of Pennsylvania, in 1897, under an act of its legislature in relation to patenting lands lying within and along navigable rivers, patents covering the entire river bed comprised in the channel; but in the opinion of this office such grants in no way affect the authority of the United States over the channel as a navigable water of the United States. As stated in the previous report of this office, the act authorizing the causeway did not have the effect of taking the channel out of the list of navigable waters, but simply gave consent to closing it by a causeway. Moreover, the actual construction of the causeway would not have had the effect of authorizing filling of the entire channel. Above and below the causeway the channel would still have been subject to the laws of the United States in regard to altering the condition or capacity of navigable waters by excavating or filling, or erecting structures therein. It is well established that the title of the States to the beds of rivers and other navigable waters is not an absolute one, but is subject to the paramount right and duty of the United States to conserve their navigability; and the grantee of the State holds the title subject to the same incidents. (Hawkins Point Lighthouse case, 39 Fed. Rep., 77; Scranton *v.* Wheeler, 179 U. S., 141; 10 Am. and Eng. Ency. of Law, 2d ed., 1134.) In the opinion of this office there is no objection to the approval of the harbor lines recommended for approval by the Chief of Engineers.

GEO. B. DAVIS,
*Judge-Advocate-General.*

[Third indorsement.]

WAR DEPARTMENT, *June 24, 1904.*

Approved as within recommended,

WM. H. TAFT,
*Secretary of War.*

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## REPORT OF CAPT. W. L. SIBERT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Pittsburg, Pa., February 23, 1904.*

GENERAL: I have the honor to submit the following report in connection with the establishment of harbor lines on the Ohio River from Davis Island dam to Lock No. 3:

Upon investigation it was found that the 1896 survey was not sufficiently accurate for harbor-line purposes and that almost all of the stations of this survey had been destroyed or obliterated and, in addition, material changes had taken place in the bed of the stream, due to both natural and artificial causes. On account of the above, and for marking the lines after establishment, an accurate triangulation system was extended over the reach, the main topographical features were located, and new maps[a] were prepared on which the proposed lines were laid down.

The maps were exhibited at a public hearing held in this office July 13, 1903, which hearing was thoroughly advertised by notices in newspapers and by circulars, which were delivered at every house along the banks, posted in local post-offices, railroad stations, and other public places, and mailed to many persons thought to be interested.

Some changes in the proposed location of the lines were found to be advisable, and after these were made the maps were placed on public exhibition from October 6 to 26, 1903, notice of this having been thoroughly distributed in the same manner as mentioned above for the public hearing.

A few more changes were made in the proposed location, and the lines as now recommended for establishment are shown on nine sheets[a] (Nos. 7 to 15) forwarded herewith.

There remain a few protests, the principal one being that of the American Steel and Wire Company, in the consideration of which objections all other protestants will be answered.

It appears that certain parties obtained from the State of Pennsylvania patents for all that portion of the bed of the Ohio River in what is known as the back channel between Neville Island and the south shore, assuming that the Government of the United States relinquishes as navigable waters this portion of the Ohio River in the following act of Congress, approved June 12, 1876:

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[a] Not printed.

AN ACT Authorizing the residents and property owners of Neville Township, county of Allegheny, and State of Pennsylvania, to close the channel of the Ohio River on the south side of Neville Island by the construction of an embankment, or causeway, from the head of said island to the southern shore of said river.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the residents and property owners of Neville Township, county of Allegheny, and State of Pennsylvania, be, and they are hereby, authorized and empowered to close the channel of the Ohio River on the south side of Neville Island, in said township, by the construction of an embankment or causeway from the head of said island to the southern shore of said river: *Provided, however*, that the Government of the United States shall not be liable for any expenses incurred in the performance of said work, or by reason thereof.

Section 8 of the river and harbor act approved June 13, 1902, repeals the act referred to above. The causeway authorized was never built, and the question as to whether the act of Congress authorizing the residents and property owners of Neville Township to construct a causeway that never was constructed was an abandonment by the United States of the bed of the river comprising the back channel specifically referred to above, is one that can only be determined in the courts.

Whether or not Congress, in section 8 of the last river and harbor act, took from anyone a vested right, can, as this office understands, only be determined in the courts.

This office has always assumed that the bed of the stream must be determined by the facts as they exist at any particular time, and it is most certainly a fact that the back channel referred to above is a part at the present time of the bed of the Ohio River, and in which the Secretary of War is authorized by section 11 of the river and harbor act of March 3, 1899, to establish harbor lines.

It is believed that a harbor line has nothing whatever to do with the river boundaries of property and that the owners of land lying riverward of harbor lines can make such use of this land as is consistent with the use of the stream as a public highway. A harbor line is merely a line in the bed of the stream riverward of which, in the opinion of the Secretary of War, fillings cannot be made or structures built without such fillings or structures interfering with navigation. This line is not forever fixed in one place. It can be changed at any time when the Secretary of War thinks it necessary for the preservation and protection of the harbor, so long as its changed location lies within the bed of the stream.

There seems to be an opinion among property owners along the rivers in the vicinity of Pittsburg that if in the establishment of harbor lines in front of their property, such lines are not placed as close together as they are in the narrowest part of the river above and below, they are deprived of a certain portion of their property; whereas to establish the lines so as to make them as near together as they are in the narrowest places above and below would be to take from the people the use of a certain amount of the navigable waters of the country in case such harbor lines were filled out to by the contiguous property owners.

The right to use all of the stream belongs to all of the people, and a property owner along the bank is not deprived of any right and does not lose any property when harbor lines are so established as to preserve to the people a full use of all of the navigable waters. An argument, therefore, as is that of the American Steel and Wire Company and the American Land Company, based on the supposition that the harbor line should be so located as to enable them to fill up the bed of the stream until it is as narrow as it is at the narrowest place both above and below the reach in question, is not thought by this office to be worthy of consideration, since it is an assumption that the public right should be made to suffer in order that they may increase their holdings and increase the value of their holdings by providing a place, to the detriment of a public utility, for the deposit of slag cinder resulting from the operation of their mills.

An examination of all of the protests submitted in this case shows that they are founded on patents issued October 23, 1901, covering river bed in the back channel, or upon grounds such as those stated above.

The lines in all cases, as shown on the maps accompanying this report, are within the bed of the stream, as this office understands the bed of the stream, and their location in the back channel, or rather the width between such lines in the back channel, was determined by this office after careful calculations as to the necessary waterway to pass the floods of the Ohio River in such a manner as not to interfere with navigation. This width and the consequent carrying capacity of the back channel, in connection with the front channel at Neville Island, were determined by ascertaining the discharge of the Ohio River during the flood of 1884, which is the highest on record, and so apportioning the channels as to carry a similar flood without materially increasing the height of such flood. There will of course be some increase, due to the fact that the present back channel is wider toward the lower end of Neville Island than it is at the upper end, and that there will be some decrease in the average width of the front channel when filling is made out to the proposed harbor lines.

It can be stated with certainty that the provision made for the passage of the floods, on which the navigation of the stream must depend, at the head of Neville Island is less than that given in the average section of the Ohio River above and below this place. The section taken at Jacks Run and used by this office, as well as by the American Steel and Wire Company in their protest, approximates to the smallest section between Davis Island Dam and Pittsburg, and the calculations submitted by the American Steel and Wire Company on blueprint accompanying their protest show that in order to pass the flood of 1884 through the two channels at the head of Neville Island with the same facility as such flood passed the Jacks Run section in 1884, the back channel at Neville Island should have a width of 585 feet, which is 25 feet more than the width proposed by the Government of the United States on maps[a] herewith.

They argue, however, that should the Ohio River be filled out to the harbor lines already established at Jacks Run, the discharging capacity of that section, when the water is at a certain elevation, will be reduced so that a corresponding section at the head of Neville Island, maintaining the present width of front channel, would require for its back channel a width of 493 feet, both of which suppositions mean an increase of flood heights, an increase of current at these narrow sections, and interference with navigation. These arguments

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[a] Not printed.

# APPENDIX F F.

# CONSTRUCTION OF LOCKS AND MOVABLE DAMS IN OHIO RIVER BETWEEN THE PENNSYLVANIA STATE LINE AND CINCINNATI, OHIO, AND IMPROVEMENT OF KANAWHA AND LITTLE KANAWHA RIVERS, WEST VIRGINIA.

## *REPORT OF MAJ. GEO. A. ZINN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. Movable dams in Ohio River.
2. Little Kanawha River, West Virginia.
3. Operating and care of lock and dam on Little Kanawha River, West Virginia.
4. Kanawha River, West Virginia.
5. Operating and care of locks and dams on Kanawha River, West Virginia.

### EXAMINATIONS AND SURVEYS.

6. Elk River, West Virginia.
7. Kanawha River, West Virginia.
8. Little Kanawha River, West Virginia, between Lock No. 5 and Burnsville.
9. Little Kanawha River, West Virginia, locks and dams not owned by the United States.
10. New River, West Virginia.

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United States Engineer Office,
*Wheeling, W. Va., July 19, 1904.*

General: I have the honor to transmit herewith the annual report of the works under my charge for the fiscal year ending June 30, 1904.

The following assistant engineers were in local charge of the works: Charles Humphreys, Dams Nos. 8, 11, and 13, Ohio River; W. M. Hall, Dams Nos. 18 and 19, Ohio River, and Little Kanawha River; and Thos. E. Jeffries, Kanawha River.

Very respectfully, your obedient servant,

Geo. A. Zinn,
*Major, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## F F 1.

## MOVABLE DAMS IN OHIO RIVER BETWEEN THE PENNSYLVANIA STATE LINE AND CINCINNATI.

### OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Dam No. 8, about 46 miles below Pittsburg, Pa.*—All the land required for this site was acquired. Plans for the lock and guide walls were completed and received the approval of the Department.

As the lock is to be founded on gravel, the plans provide for a foundation of piling to be driven to rock with close-driven sheet piling along both sides of the river wall and gate tracks, outer side of each gate recess, and channel side of land wall and each guide wall. The exposed sides of the entire foundation, considering the lock and guide walls as a whole, are to be protected with heavy riprap, except the lower end of river wall and lower gate track which are to be protected by a crib filled with stone. The plans also provide for paving the floor of the lock chamber with concrete. Openings are to be left in this floor to prevent its damage in case of any upward pressure of water under the floor. No drift chute or power or flushing conduits are provided for, as they are considered unnecessary. The emptying of the lock will be done through valves in the gates, the filling through valves in the river wall. Only two Poirée dams are to be built, instead of four as in previous plans. These plans were prepared in accordance with the report of a Board of Engineer officers, a synopsis of which is given in the Annual Report of the Chief of Engineers for 1903, page 1714, under Dam No. 13.

This method of construction, together with the increased price of material and labor, has added considerably to cost of lock and dam construction on the Ohio, and the structures where founded on sand and gravel can not be built within the original estimates ($850,000 each). Past experience shows that only the best work will stand in the Ohio River.

A contract was entered into June 8, 1904, with The T. A. Gillespie Company of Pittsburg, Pa., for building so much of the lock and guide walls as can be done within the limit of $255,000, with the proviso that should additional funds become available the company will complete the work. Preparations were in progress at the close of the year for commencing work under the contract.

A temporary building to be used as an office is under construction, an emergency contract having been entered into with Finley Brothers Company of Chester, W. Va.

*Dam No. 11, about 77 miles below Pittsburg, Pa.*—There is still one piece of land to be acquired on the abutment side of the river, the land on the lock side and one piece on the abutment side having been purchased. Plans similar to those described above under Dam No. 8, for lock and guide walls, were completed and received the approval of the Department.

A contract was entered into June 30, 1904, with the Ætna Construction Company of Wheeling, W. Va., for building so much of the lock and guide walls as can be done within the limit of $250,000, with the proviso that should additional funds become available the company will complete the work. Although the contract has not been approved, the company is making preparations to commence work.

Under an emergency contract entered into with A. S. Craig and John Exner of Wellsburg, W. Va., a temporary building is being constructed which is to be used as an office during construction of lock and dam.

*Dam No. 13, about 96 miles below Pittsburg, Pa.*—Plans embodying the modifications as recommended by a Board of Engineer officers were completed, and a supplemental contract covering same entered into with The Sheridan-Kirk Contract Company. As the Government furnishes the cement to be used in the lock construction, a contract for furnishing the Portland cement required to December 31, 1904, was entered into with the Atlas Portland Cement Company of New York, the natural cement for the foundations being furnished by L. S. McKallip & Co. of Pittsburg, Pa., under a contract previously made. A small survey of the additional land required for building sites was made, and 5,800 barrels of natural and 5,740 barrels of Portland cement received.

The Sheridan-Kirk Contract Company, contractors for building the masonry of lock, accomplished the following work during the year:

| | | |
|---|---|---|
| Excavation | cubic yards.. | 10,128 |
| Rubble masonry | do.... | 94 |
| Concrete | do.... | 8,037 |
| Timber | feet B. M.. | 6,733 |
| Iron and steel | pounds.. | 89,391 |
| Iron pipe | linear feet.. | 61 |
| Sheet piling | do.... | 14,104 |
| Bricks | number.. | 42,000 |
| Piles | do.... | 1,237 |
| Filling | cubic yards.. | 139 |

At the close of the year the power-house foundation, river-wall foundation, and 619 feet of river wall were completed, and the driving of piling and sheet piling for the remainder of lock foundation was well advanced.

*Dam No. 18, about 179 miles below Pittsburg, Pa.*—Designs were prepared for the dam for this site and the one best adapted for the locality forwarded to the Department for approval. Plans for lock machinery are in preparation.

The cement to be used in the lock and guide walls is to be furnished by the Government, and a contract for furnishing that required to December 31, 1904, was entered into with the Atlas Portland Cement Company of New York. Seven thousand five hundred barrels of Portland cement were received.

Under the contract entered into with The Evansville Contract Company the following work was accomplished:

| | | |
|---|---|---|
| Timber | feet B. M.. | 331,682 |
| Common filling | cubic yards.. | 25,042 |
| Stone filling | do.... | 1,538 |
| Common excavation | do.... | 12,535 |
| Rock excavation | do.... | 3,434 |
| Concrete | do.... | 6,793 |
| Bolt holes | linear feet.. | 124 |
| Iron and steel | pounds.. | 85,941 |
| Vitrified pipe | linear feet.. | 450 |

The following is the condition of the work at the close of the year: The greater part of the common excavation (material overlying rock)

| | |
|---|---|
| March 3, 1903: | |
| Continuing construction of lock at Dam No. 8 | $200,000 |
| Continuing construction of lock at Dam No. 11 | 200,000 |
| Continuing construction of Dams Nos. 13 and 18 | 450,000 |
| April 28, 1904: | |
| Continuing construction of Dam No. 8 | 50,000 |
| Continuing construction of Dam No. 11 | 50,000 |
| Total | 1,731,600 |

### ABSTRACT OF CONTRACTS IN FORCE FOR IMPROVING OHIO RIVER BELOW PITTSBURG, PA.

#### *Lock for movable Dam No. 13.*

Contractor: The Sheridan-Kirk Contract Company.

Rate: Cofferdam, at $10 per linear foot; temporary piling, 35 cents per linear foot; sheet piling, 35 cents per linear foot; ordinary excavation, 30 cents per cubic yard; deposit excavation, 50 cents per cubic yard; channel dredging, 25 cents per cubic yard; rock excavation $3 per cubic yard; ordinary filling, 30 cents per cubic yard; stone filling, $3 per cubic yard; special ashlar masonry, $16 per cubic yard; coping masonry, $17 per cubic yard; rubble masonry, $5.50 per cubic yard; brick masonry, $11 per cubic yard; concrete masonry (cement furnished by United States), $2.85 per cubic yard; oak timber, $50 per thousand; hemlock timber, $35 per thousand; cast iron, 5 cents per pound; wrought iron, 5 cents per pound; steel, 5 cents per pound; iron pipe, 3-inch, 15 cents per linear foot.

Date of approval: July 5, 1901.

Date of beginning: September 7, 1901.

Date of expiration: 400 fair working days.

#### *Lock for movable Dam No. 18.*

Contractor: The Evansville Contract Company.

Rate: Grubbing and clearing at $25 per acre; hemlock timber and plank, $40 per thousand; sheet piling, $45 per thousand; round timber, 25 cents per linear foot; round piling, 30 cents per linear foot; common filling, 27 cents per cubic yard; puddling, $2 per cubic yard; stone filling, $1.50 per cubic yard; common excavation, 25 cents per cubic yard; rock excavation, $2.50 per cubic yard; concrete (cement furnished by United States), $4 per cubic yard; oak timber, $50 per thousand; paving, $3.50 per cubic yard; curbing, $7 per cubic yard; bolt holes, 50 cents per linear foot; iron and steel, 5½ cents per pound; vitrified pipe, 8-inch, 35 cents per linear foot; vitrified pipe, 12-inch, 50 cents per linear foot; galvanized-iron pipe, 3-inch, 60 cents per linear foot; galvanized-iron pipe, 2-inch, 40 cents per linear foot; galvanized-iron pipe, 1½-inch, 40 cents per linear foot; highway, 50 cents per square yard.

Date of approval: December 10, 1902.

Date of beginning: January 14, 1903.

Date of expiration: 300 fair working days.

#### *Natural cement at Dam No. 13.*

Contractors: L. S. McKallip & Co.

Rate: In paper bags at 81 cents per barrel.

Date of approval: July 29, 1901.

Date of beginning: When notified.

Date of expiration: December 31, 1902, or on completion of construction work.

#### *Portland cement for Dams Nos. 13 and 18.*

Contractor: Atlas Portland Cement Company.

Rate: In canvas sacks at $1.60 per barrel.

Date of approval: May 14, 1904.

Date of beginning: When notified.

Date of expiration: December 31, 1904.

### *Lock for movable Dam No. 8.*

Contractor: The T. A. Gillespie Company.

Rate: Grubbing and clearing at $100 per acre; timber, $35 per thousand; sheet piling, 50 cents per linear foot; round piling, 41 cents per linear foot; common filling, 30 cents per cubic yard; stone filling, $2 per cubic yard; stone steps, $1.25 per linear foot; common excavation, 50 cents per cubic yard; concrete, $5.95 per cubic yard; white-oak timber, $60 per thousand; paving, $6 per cubic yard; bolt holes, $1 per linear foot; iron and steel, 6 cents per pound; cast-iron pipe, 6-inch, $1.50 per linear foot; galvanized-iron pipe, 3-inch, $1 per linear foot; galvanized-iron pipe, 1½-inch, 60 cents per linear foot.

Date of approval: June 24, 1904.

Date of beginning: July 27, 1904.

Date of expiration: 210 fair working days.

### *Temporary building at Dam No. 8.*

Contractor: Finley Brothers Company.

Rate: $735.

Date of contract: June 17, 1904.

Date of beginning: June 28, 1904.

Date of expiration: July 27, 1904.

### *Temporary building at Dam No. 11.*

Contractors: A. S. Craig and John Exner.

Rate: $748.85.

Date of contract: June 22, 1904.

Date of beginning: July 2, 1904.

Date of expiration: August 1, 1904.

## COMMERCIAL STATISTICS.

*Freight handled at the wharves of some of the principal cities between Dam No. 8, Ohio River, and Ripley, Ohio, during the calendar year 1903.*

| Name of city. | Freight. | Passengers. |
|---|---|---|
| | *Tons.* | *Number.* |
| East Liverpool, Ohio | 49,400 | 16,200 |
| Steubenville, Ohio | 8,500 | 10,500 |
| Wellsburg, W. Va | 5,200 | .......... |
| Wheeling, W. Va | 147,060 | 82,050 |
| Marietta, Ohio | 13,562 | 14,050 |
| Ravenswood, W. Va | 100,000 | .......... |
| Racine, Ohio | 4,500 | .......... |
| Middleport, Ohio | 8,644 | 10,900 |
| Point Pleasant, W. Va | 1,800 | 20,000 |
| Catlettsburg, Ky | 150,000 | 30,000 |
| Ashland, Ky | 1,000,000 | .......... |
| Ironton, Ohio | 73,000 | 25,000 |
| Portsmouth, Ohio | 1,000,000 | 10,000 |
| Ripley, Ohio | 60,000 | .......... |

The number of passengers includes excursionists.

The information contained in the foregoing table was obtained through the mayors of the several cities mentioned. It appears that no accurate record is kept of tonnage and passenger traffic at most of the towns on the Ohio River, and the quantities given in the above table are only approximately correct.

## F F 2.

## IMPROVEMENT OF LITTLE KANAWHA RIVER, WEST VIRGINIA.

On August 13, 1903, a small force was put to work at Burnsville, W. Va., to remove the obstructions which had re-formed in the river from Burnsville to Burning Springs, a distance of 81½ miles. Work was completed September 25, after removing the following: Four hundred and thirty-two snags, 125 fallen trees, 9 logs, 46 stumps, and 1,158 cubic yards of bowlders; 375 overhanging trees were deadened and 218 felled. This put the channel in fairly good condition for navigation by flatboats, rafts, and other small craft. There is still a small balance available, which will be applied to removing obstructions from time to time.

There are a number of places in the above-mentioned section of the river where navigation is quite difficult, and the milldam at Stouts Mills, W. Va., is an obstruction where freight must be transferred either over or around.

The preparation of an estimate of the probable cost of each of the four locks and dams in said river not owned by the Government, and a report as to their present condition, probable cost of repair, and the advisability of acquiring the same in the interest of navigation as called for in the river and harbor act of June 13, 1902, was completed. The report and estimate are contained in House Document No. 309, Fifty-eighth Congress, second session.

As a protection against fire, the Government buildings at Lock No. 5 were provided with fire extinguishers.

Five hundred dollars can be profitably expended on this river each year in removing obstructions and maintaining the channel, but to remove the larger obstructions would require a much greater sum.

The commercial statistics are contained in the report for operating and care of lock and dam on Little Kanawha River, West Virginia.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $1,094.76 |
| Amount received from sale | | 125.00 |
| | | 1,219.76 |
| June 30, 1904, amount expended during fiscal year: | | |
| For examination | $65.00 | |
| For maintenance of improvement | 873.41 | |
| | | 938.41 |
| July 1, 1904, balance unexpended | | 281.35 |
| July 1, 1904, outstanding liabilities | | 33.00 |
| July 1, 1904, balance available | | 248.35 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | | 1,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| August 14, 1876 | $7,300 | August 11, 1888 | $25,000 |
| June 18, 1878 | 18,000 | September 19, 1890 | 40,000 |
| March 3, 1879 | 18,000 | June 3, 1896 | 1,500 |
| June 14, 1880 | 15,000 | March 3, 1899 | 743 |
| March 3, 1881 | 40,000 | June 13, 1902 | 1,000 |
| August 2, 1882 | 31,000 | | |
| August 5, 1886 | 16,875 | Total | 214,418 |

NOTE.—Received from sale, $186.10.

# F F 3.

## OPERATING AND CARE OF LOCK AND DAM ON LITTLE KANAWHA RIVER, WEST VIRGINIA.

Lock and Dam No. 5 is located about 41 miles from the mouth of the river (Parkersburg), and is a continuation of the slack-water system controlled by the Little Kanawha Navigation Company. The locks and dams (four) owned by the navigation company often cause a stoppage of navigation, owing to their leaky condition. During the past fiscal year navigation was suspended seventy-seven days on account of low water, and eighty days on account of ice. The suspension caused by low water is almost entirely due to the bad condition of the locks and dams below, owned by the navigation company.

The following work, necessary to keep the lock and dam and their appurtenances in good condition, was accomplished during the year: Gates and valves of lock were repaired, and the former painted; dam repaired by replacing 15,000 feet of timber, 150 cubic yards of stone, and 500 driftbolts; cement paving behind land wall of lock repaired by replacing 583 square feet; lock houses repaired by reshingling part of one house, and papering and painting both houses; walk on Government ground repaired by laying 826 linear feet of cement paving; river banks above abutment, below lock, and back of lower guide wall protected with 525 cubic yards of stone. The old storehouse is being replaced by a new one which will also contain an office and a shop; its reconstruction is under contract. New needles for the provisional dams in both ends of lock were purchased. At the close of the year the Government structures, with the exception of the storehouse and the old sheds, were in good condition.

ALLOTMENTS.

| | | | |
|---|---|---|---|
| November 28, 1891 | $1,500.00 | July 21, 1899 | $2,331.58 |
| July 15, 1892 | 4,426.65 | July 14, 1900 | 2,271.61 |
| July 21, 1893 | 3,837.97 | June 25, 1901 | 3,470.84 |
| July 16, 1894 | 3,491.03 | July 12, 1902 | 2,705.25 |
| July 20, 1895 | 3,378.17 | July 20, 1903 | 4,318.97 |
| July 24, 1896 | 830.72 | March 7, 1904 | 500.00 |
| July 23, 1897 | 1,684.03 | | |
| August 8, 1879 | 3,038.53 | Total | 37,785.35 |

*Summary of expenditures for operating and care of lock and dam on Little Kanawha River, West Virginia, for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Office expenses and superintendence | $272.43 |
| Labor | 1,264.59 |
| Fuel | 16.00 |
| Expenses | 75.11 |
| Repairs | 1,756.92 |
| Total | 3,385.05 |

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ABSTRACT OF CONTRACT IN FORCE FOR LITTLE KANAWHA RIVER, WEST VIRGINIA.

*Frame storehouse at Lock No. 5.*

Contractor: Stephen Davidson.
Rate: $1,675.
Date of contract: May 16, 1904.
Date of beginning: June 5, 1904.
Date of expiration: August 4, 1904.

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COMMERCIAL STATISTICS.

*Commerce that has passed Lock No. 5 since it was opened to navigation.*

| Fiscal year— | Tons. | Calendar year— | Tons. |
|---|---|---|---|
| 1890 | 140,115 | 1897 | 127,943 |
| 1891 | 190,688 | 1898 | 122,405 |
| 1892 | 244,254 | 1899 | 138,664 |
| 1893 | 137,072 | 1900 | 119,439 |
| 1894 | 106,412 | 1901 | 122,190 |
| 1895 | 179,240 | 1902 | 69,706 |
| 1896 | 105,212 | 1903 | 73,464 |
| 1897 | 176,169 | | |

*Detailed statement of commerce for calendar year 1903.*

| Articles. | Amount. | Articles. | Amount. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Bricks | 112 | Live stock | 19 |
| Carbon black | 747 | Lumber | 85 |
| Casing | 25 | Salt | 28 |
| Cement | 194 | Saw logs | 47,760 |
| Coal | 239 | Stone | 20 |
| Dry goods | 213 | Sundries | 2,144 |
| Farm products | 749 | Ties, railroad | 17,838 |
| Groceries and paints | 1,029 | | |
| Hardware | 2,277 | Total | 73,464 |
| Iron | 85 | | |

Number of passengers, 8,989.

*List of stern-wheel boats plying on the Little Kanawha River, West Virginia, during calendar year 1903.*

| Name of boat. | Length. | Breadth. | Depth. | Tonnage. |
|---|---|---|---|---|
| Steamboats: | *Feet.* | *Feet.* | *Feet.* | |
| Darling | 100 | 22.7 | 3.6 | 78.80 |
| Burnadina King | 90 | 18.0 | 3.5 | 106.00 |
| French | 104 | 19.5 | 4.2 | 75.78 |
| Telephone | 93 | 16.0 | 2.6 | 73.00 |
| Louise | 102 | 21.6 | 3.0 | 77.00 |
| Excel | 95 | 18.0 | 3.0 | 60.00 |
| Katie | 90 | 20.0 | 3.0 | 75.00 |
| Boats propelled by gasoline: | | | | |
| Clipper | 75 | 8.0 | 1.7 | 10.00 |
| Calhoun | 70 | 8.0 | 2.0 | 10.00 |
| Edith H | 60 | 9.0 | 2.0 | 12.00 |
| Creston | 65 | 9.0 | 2.4 | 12.00 |
| A. C. Barney | 75 | 10.0 | 2.0 | 12.00 |
| Hurricane | 65 | 7.5 | 1.8 | 10.00 |
| Mabel B | 80 | 7.5 | 1.7 | 10.00 |
| Carbon Black | 85 | 7.5 | 2.0 | 10.00 |
| H. B. Stout | 85 | 7.5 | 2.0 | 10.00 |
| Orion | 50 | 7.5 | 2.0 | 6.00 |
| Winona | 85 | 7.5 | 2.0 | 10.00 |
| Wabash | 70 | 8.0 | 2.0 | 10.00 |
| Florence W | 40 | 7.0 | 2.0 | 5.00 |
| Leone | 70 | 8.0 | 2.5 | 12.00 |
| Cruiser | 60 | 14.5 | 2.5 | 13.11 |
| Joe Kellar | 50 | 9.0 | 3.5 | 10.00 |

*Report of lockages at Lock No. 5, Little Kanawha River, West Virginia, for the calendar year ending December 31, 1903.*

| | |
|---|---|
| Steamboats | 1,443 |
| Barges and flats | 481 |
| Rafts | 1,335 |
| Miscellaneous | 43 |
| Total | 3,302 |
| Number of lockages | 3,294 |

## F F 4.

## IMPROVEMENT OF KANAWHA RIVER, WEST VIRGINIA.

The work provided for under the modified project for the expenditure of the funds appropriated by the act of June 4, 1897, was practically completed with the construction of three guard cribs at Lock No. 3, which was done under contract with Riley E. and Frank C. Williams.

A new project for the expenditure of the balance remaining from the above-mentioned act was approved, and provides for the following: Grading land; constructing sewers, walks, additional fences, back porches, lock houses (2) at Lock No. 6, office buildings, coal sheds, water-closets, carpenter and blacksmith shops, storehouse (1), guide cribs at Locks Nos. 2, 3, and 11, bridge at Lock No. 8, and retaining walls at Lock No. 11; purchasing additional land at Locks Nos. 5 and 6, window blinds, sinks and pumps for lock houses, lights for use at the movable dams, and machinery for operating gates, etc., with steam; concreting floors in cellars of lock houses; protecting river banks; equipping telephone system with metallic circuit, and Government buildings and boats with fire extinguishers; and dredging.

Window blinds, sinks, and pumps for lock houses were purchased, as was also material for constructing sewers and walks at the locks and retaining walls at Lock No. 11.

About 75 per cent of the work for constructing sewers, 20 per cent of that for constructing walks, 85 per cent of that for installing sinks and pumps in the lock houses, and 90 per cent of that for fitting lock houses with window blinds were completed. The work on the retaining walls at Lock No. 11 is well under way, as is also that on grading Government land at Locks Nos. 9 and 10. Fifty-three fire extinguishers were purchased and installed.

A contract was entered into May 21, 1904, with Robert Shore and Bennett Murrell of Huntington, W. Va., for constructing two lock houses at Lock No. 6. Work was commenced on June 7 and fair progress is being made. W. H. Hanna of Charleston, W. Va., was awarded the contract for constructing office buildings, coal sheds, water-closets, shops, storehouse, back porches, and fences at the ten locks. The papers were signed and forwarded for approval. Proposals, to be opened July 11, for building guide cribs at Locks Nos. 2, 3, and 11 were invited.

The dredge, crane boat, and towboat belonging to this river were employed in dredging in the pools and lock approaches. During the year 31,840 cubic yards of material and 52 cubic yards of stone were removed. Additional work accomplished by this plant is given under the report for operating and care of locks and dams on Kanawha River. The old spuds of the dredge were replaced, as were also the propeller wheels of the towboat.

It does not appear that the use of the new towboat *James Rumsey* during the past year was such as to afford me an opportunity to state whether or not the boat is a decided improvement over the ordinary type of towboat.

The field work of the survey of the river between Lock No. 2 and the Falls, which was commenced June 15, 1903, was completed August 21, after which the notes were platted. A report on same was forwarded November 21, and is contained in House Document No. 305, Fifty-eighth Congress, second session.

The commercial statistics for this river are given in the report for operating and care of locks and dams on Kanawha River.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $144,380.20 |
| Amount received from sales, etc | 1,627.70 |
| | 146,007.90 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 15,007.45 |
| July 1, 1904, balance unexpended | 131,000.45 |
| July 1, 1904, outstanding liabilities | 2,640.70 |
| July 1, 1904, balance available | 128,359.75 |
| July 1, 1904, amount covered by uncompleted contracts | 5,900.00 |

APPROPRIATIONS.

| | |
|---|---|
| March 3, 1873 | $25,000.00 |
| June 23, 1874 | 25,000.00 |
| March 3, 1875 | 300,000.00 |
| August 14, 1876 | 270,000.00 |
| June 18, 1878 | 222,000.00 |
| March 3, 1879 | 150,000.00 |
| June 14, 1880 | 200,000.00 |
| March 3, 1881 | 200,000.00 |
| August 2, 1882 | 200,000.00 |
| July 5, 1884 | 200,000.00 |
| August 5, 1886 | 187,500.00 |
| February 1, 1888 | 34,379.30 |
| February 1, 1888 | $30,370.15 |
| August 11, 1888 | 350,000.00 |
| September 19, 1890 | 300,000.00 |
| July 13, 1892 | 225,000.00 |
| March 3, 1893 | 500,000.00 |
| March 2, 1895 | 580,700.00 |
| June 4, 1897 | 273,000.00 |
| Total | 4,272,949.45 |
| Carried to surplus fund | 1,086.31 |
| Balance | 4,271,863.14 |

NOTE.—Received from sales, etc., $1,627.70.

## F F 5.

## OPERATING AND CARE OF LOCKS AND DAMS ON KANAWHA RIVER, WEST VIRGINIA.

The slack-water system of the Kanawha River consists of 10 locks and dams, of which 2 are fixed and 8 movable, and provides for 6-foot navigation over a distance of about 90 miles from Point Pleasant upstream. As mentioned in previous reports, the cost of maintaining this system is increasing, owing to its length of service. This is especially true at the movable dams, the first of which (Nos. 4 and 5) were completed in 1880, and the last (Nos. 9, 10, and 11) in 1898. At the close of the year the works were practically in good condition.

The movable dams were operated without serious accident or delay, as follows: Dams Nos. 4–8, raised five times and lowered five times; Dams Nos. 9 and 10, raised four times and lowered four times; Dam No. 11, raised seven times and lowered seven times.

Unusual conditions prevailed during the first part of the winter, due to low water and ice. Ice interfered with locking at the fixed dams for about sixty-five days.

The following is a summary of the work accomplished:

*Lock No. 2.*—Material was received for repair of guard cribs; good progress made toward constructing new lock gates; and 1,200 willows planted in the washout below abutment.

*Lock No. 3.*—Five new valves were placed in lock gates; and 640 cubic yards of riprap set and 460 cubic yards reset on bank below lock.

*Lock No. 4.*—The interior of two of the small lock houses was painted and papered; 47 new wickets placed in the navigation pass of dam, completing the set of which 15 wickets were placed last year; and 7 iron check posts set along lock wall. A new service boat (small) was purchased, and new pass trestles were contracted for with the York Bridge Company of York, Pa.

*Lock No. 5.*—A set (31) of new pass trestles, purchased under contract with B. Wallis & Co., was placed; the chains on 35 pass wickets replaced; and the interior of 1 small lock house and of the office painted, and that of 2 small lock houses painted and papered.

*Lock No. 6.*—The new gates, upper and lower, for the lock were completed and hung; 29 new weir wickets placed; the interior and exterior of 1 double and 1 small house painted, and the interior of the small house papered.

*Lock No. 7.*—The river bank below lock was protected by placing 175 cubic yards of riprap; 368 feet of fence built; and the interior of 1 small lock house painted and papered.

*Lock No. 8.*—On the abutment side the river bank was graded and 620 cubic yards of riprap reset, and below the lock the bank was protected by resetting 25 cubic yards of riprap. A new tin roof was put on 1 lock house and new shingle roofs on the shops. The exterior of 1 lock house was painted.

*Lock No. 9.*—The service boats were repaired, and part of 1 lock house and interior of office painted.

*Lock No. 10.*—Sixty-eight foot planks were put on the weir of dam.

*Lock No. 11.*—A service boat and crib at head of river wall of lock were repaired.

*United States telephone line.*—The following repairs were made to keep the line in good condition: 453 new poles were set, 356 old poles reset, and 15½ miles of new wire strung.

*U. S. dredge Addison.*—In addition to the work reported under improving Kanawha River, 15,428 cubic yards of deposit and 95 snags were removed. The boat's cabin was altered so as to provide better ventilation.

U. S. towboat *James Rumsey* was employed as tender to the dredge and also in transporting material, etc., for repairs.

U. S. launch *Mascot* was employed transporting employees, etc.

When there is a slight rise in the Ohio River, even though not sufficient for floating coal barges, by maneuvering the dams on the Kanawha River enough water is supplied on which coal barges can be sent to points on the Ohio as far down as Cincinnati. This was done with good results during the past year.

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ALLOTMENTS.

| | | |
|---|---|---|
| For fiscal year 1885 | | $7,075.00 |
| For fiscal year 1886 | | 8,710.00 |
| July 8, 1886 | | 11,170.00 |
| June 17, 1887 | | 13,289.00 |
| February 4, 1888 | | 3,549.70 |
| August 16, 1888 | | 19,990.02 |
| July 11, 1889 | | 19,261.61 |
| July 16, 1890 | | 25,702.27 |
| October 9, 1890 | | 3,400.00 |
| July 14, 1891 | | 19,453.00 |
| July 6, 1892 | | 21,891.64 |
| July 12, 1893 | | 24,549.41 |
| July 10, 1894 | | 30,600.00 |
| July 2, 1895 | | 30,200.00 |
| July 25, 1896 | | 37,082.59 |
| August 2, 1897 | | 22,700.77 |
| July 26, 1898 | | 36,331.90 |
| September 29, 1898 | | 2,650.00 |
| June 2, 1899 | | $14,000.00 |
| August 2, 1899 | | 36,416.13 |
| April 10, 1900 | | 1,400.00 |
| July 13, 1900 | | 49,444.47 |
| July 3, 1901 | | 47,506.31 |
| May 16, 1902 | | 2,500.00 |
| June 23, 1902 | | 9,500.00 |
| July 17, 1902 | | 52,859.86 |
| July 14, 1903 | | 61,946.86 |
| Total | | 613,180.54 |
| Withdrawn: | | |
| Fiscal year 1888 | $2,049.70 | |
| Fiscal year 1890 | .01 | |
| | | 2,049.71 |
| Balance | | 611,130.83 |

*Summary of expenditures for operating and care of locks and dams on Kanawha River, West Virginia, for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Office expenses and superintendence | $6,739.49 |
| Labor | 39,505.79 |
| Fuel | 548.85 |
| Expenses | 780.38 |
| Repairs | 17,157.08 |
| Total | 64,731.59 |

### ABSTRACT OF CONTRACTS IN FORCE FOR KANAWHA RIVER, WEST VIRGINIA.

*Thirty-four steel trestles, complete, for Dam No. 4.*

Contractor: York Bridge Company.
Rate: 3.84 cents per pound.
Date of approval: March 26, 1904.
Date of beginning: April 17, 1904.
Date of expiration: August 15, 1904.

*Two lock houses at Lock No. 6.*

Contractors: Robert Shore and Bennett Murrell.
Rate: $2,950 each.
Date of approval: May 26, 1904.
Date of beginning: June 27, 1904.
Date of expiration: 120 fair working days.

### COMMERCIAL STATISTICS.

*Statement of number of tons of coal, including that manufactured into coke, shipped by river from mines on the Kanawha below Kanawha Falls for the several years named.*

| Fiscal year— | Tons. | Calendar year— | Tons. |
|---|---|---|---|
| 1890 | 968,462 | 1897 | 650,680 |
| 1891 | 1,030,454 | 1898 | 1,089,160 |
| 1892 | 1,071,511 | 1899 | 942,800 |
| 1893 | 919,320 | 1900 | 1,240,680 |
| 1894 | 1,032,840 | 1901 | 1,370,180 |
| 1895 | 879,304 | 1902 | 937,880 |
| 1896 | 922,000 | 1903 | 1,333,920 |
| 1897 | 848,600 | | |

*Tonnage of the Kanawha River for the calendar year ending December 31, 1903.*

| Articles. | | Quantity. | Tonnage. |
|---|---|---|---|
| Coal | bushels.. | 33,348,000 | 1,333,920 |
| Timber | feet B. M.. | 33,374,000 | 55,623 |
| Staves, oak | number.. | 239,500 | 1,796 |
| Bark and wood for tanning | cords.. | 490 | 955 |
| Hoop poles | number.. | 879,000 | 2,198 |
| Laths | do.... | 1,831,000 | 366 |
| Railroad ties, oak | do.... | 376,700 | 40,781 |
| Shingles | do.... | 277,000 | 41 |
| Bricks | do.... | 542,200 | 1,355 |
| Salt | barrels.. | 7,022 | 983 |
| Merchandise and produce in steamboats | tons.. | | 68,025 |
| Total | | | 1,506,043 |

*Total tonnage of the Kanawha River for the several years named.*

| Year ending June 30— | Tonnage. | Calendar year— | Tonnage. |
|---|---|---|---|
| 1890 | 1,127,232 | 1897 | 832,002 |
| 1891 | 1,225,355 | 1898 | 1,244,334 |
| 1892 | 1,360,750 | 1899 | 1,124,364 |
| 1893 | 1,116,537 | 1900 | 1,475,930 |
| 1894 | 1,222,530 | 1901 | 1,547,610 |
| 1895 | 1,082,342 | 1902 | 1,090,797 |
| 1896 | 1,162,782 | 1903 | 1,506,043 |
| 1897 | 1,124,843 | | |

*Commerce passing each of the ten locks and dams in Kanawha River, West Virginia, during the calendar year ending December 31, 1903.*

| Articles. | | Lock No. 2. | Lock No. 3. | Lock No. 4. | Lock No. 5. | Lock No. 6. |
|---|---|---|---|---|---|---|
| Coal | bushels.. | 2,091,000 | 4,271,000 | 12,235,250 | 19,958,500 | 21,804,000 |
| Coke | tons.. | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 |
| Lumber, etc | feet.. | 240,200 | 293,500 | 519,030 | 868,900 | 2,570,700 |
| Shingles | number.. | 42,000 | 66,100 | 63,000 | 126,000 | 42,000 |
| Laths | do.... | 2,000 | 5,000 | 7,000 | 24,000 | 57,000 |
| Bricks | do.... | 2,500 | 41,075 | 56,240 | 138,900 | 156,100 |
| Miscellaneous freight | tons.. | 5,409 | 7,494 | 12,278 | 18,996 | 26,349 |
| Steamboats | number.. | 1,383 | 1,456 | 1,842 | 2,035 | 1,854 |
| Coal barges | do.... | 343 | 615 | 1,734 | 2,857 | 3,210 |
| Other craft | do.... | 66 | 87 | 91 | 177 | 78 |
| Salt | barrels.. | 43 | 310 | 235 | 1,193 | 5,700 |
| Railroad ties | number.. | ........ | ........ | ........ | ........ | 34,500 |
| Staves | do.... | ........ | ........ | ........ | ........ | 35,000 |
| Hoop poles | do.... | ........ | ........ | ........ | ........ | 56,500 |
| Bark | cords.. | ........ | ........ | ........ | ........ | ........ |
| Lockages | number.. | 1,498 | 1,674 | 1,449 | 1,819 | 1,383 |
| Dams up | number days.. | ........ | ........ | 194 | 205 | 202 |
| Passengers | number.. | 8,300 | 10,876 | 15,080 | 22,037 | 25,400 |

| Articles. | Lock No. 7. | Lock No. 8. | Lock No. 9. | Lock No. 10. | Lock No. 11. |
|---|---|---|---|---|---|
| Coal ..........bushels.. | 24,042,000 | 27,235,500 | 31,093,300 | 32,446,100 | 32,407,000 |
| Coke ..........tons.. | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 |
| Lumber, etc ..........feet.. | 6,531,825 | 11,066,085 | 9,013,050 | 10,560,350 | 14,196,600 |
| Shingles..........number.. | 70,000 | 80,500 | 42,500 | 193,000 | 50,650 |
| Laths ..........do.... | 1,773,900 | 1,536,900 | 1,404,600 | 1,347,100 | 1,815,000 |
| Bricks ..........do.... | 337,250 | 324,800 | 275,330 | 388,100 | 403,300 |
| Miscellaneous freight..........tons.. | 28,150 | 26,711 | 27,403 | 32,702 | 36,384 |
| Steamboats..........number.. | 1,905 | 2,129 | 1,992 | 2,193 | 2,202 |
| Coal barges ..........do.... | 3,536 | 4,217 | 4,903 | 4,846 | 4,908 |
| Other craft..........do.... | 178 | 198 | 146 | 232 | 223 |
| Salt..........barrels.. | 7,304 | 6,168 | 4,108 | 4,989 | 5,229 |
| Railroad ties ..........number.. | 61,400 | 121,962 | 162,175 | 226,075 | 376,675 |
| Staves..........do.... | 92,000 | 176,300 | 136,030 | 210,300 | 239,500 |
| Hoop poles..........do.... | 145,800 | 228,800 | 550,000 | 614,840 | 878,915 |
| Bark ..........cords.. | 30 | 30 | 30 | 30 | 30 |
| Lockages..........number.. | 1,486 | 1,625 | 1,621 | 1,780 | 1,508 |
| Dams up..........number days.. | 206 | 204 | 201 | 201 | 169 |
| Passengers ..........number.. | 23,034 | 21,304 | 15,345 | 19,346 | 28,991 |

*List of steamboats plying Kanawha River, West Virginia, for the calendar year 1903.*

[All stern-wheel, except as noted.]

| Name of boat | Character. | Length. | Breadth. | Depth. | Tonnage. |
|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | |
| Greenland [a] | Packet | 204.4 | 31.9 | 5.4 | 294.00 |
| Kanawha | do | 185.0 | 35.0 | 4.0 | 429.07 |
| Tacoma | do | 182.3 | 32.4 | 5.0 | 276.00 |
| Henry M. Stanley | do | 180.0 | 32.4 | 5.5 | 293.71 |
| Greenwood | do | 165.0 | 32.0 | 4.5 | 270.00 |
| Columbia | do | 156.0 | 24.2 | 4.0 | 197.96 |
| Helen M. Gould | do | 140.0 | 25.0 | 4.0 | 149.40 |
| Cricket | do | 132.0 | 18.0 | 3.0 | 65.00 |
| Argand | do | 130.0 | 24.8 | 4.0 | 96.00 |
| Liberty [a] | do | 128.4 | 20.5 | 4.2 | 68.00 |
| Baxter | do | 121.0 | 22.0 | 3.5 | 75.00 |
| Evergreen | do | 120.0 | 22.0 | 4.0 | 99.00 |
| Calvert | do | 120.0 | 20.0 | 3.5 | 110.00 |
| Neva | do | 117.0 | 21.6 | 3.4 | 71.48 |
| Mildred | do | 116.0 | 24.0 | 3.0 | 92.00 |
| Enos Taylor | do | 116.0 | 20.0 | 3.5 | 64.00 |
| Katie Mc | do | 98.1 | 18.0 | 2.8 | 41.00 |
| Unique [b] | do | 90.0 | 14.0 | 4.6 | 33.00 |
| Winona [b] | do | 81.0 | 8.0 | 1.8 | 10.00 |
| Leone [b] | do | 60.0 | 10.4 | 2.5 | 9.00 |
| Genevieve | do | 59.0 | 11.9 | 2.6 | 14.44 |
| Laura [b] | do | 57.0 | 10.0 | 3.5 | 9.60 |
| Laura | do | 54.0 | 8.0 | 2.5 | 9.00 |
| Cuba | do | 50.0 | 9.6 | 2.5 | 10.00 |
| Newt Cooper | do | 47.5 | 8.7 | 2.6 | 11.00 |
| J. P. Lightner | do | 40.0 | 12.6 | 3.0 | 8.00 |
| E. R. Andrews | Towboat | 165.0 | 32.5 | 5.2 | 351.07 |
| Florence Marmet | do | 155.0 | 30.0 | 5.0 | 263.00 |
| Cruiser | do | 152.0 | 30.0 | 5.0 | 341.00 |
| Robert P. Gillham | do | 149.5 | 31.5 | 4.3 | 158.00 |
| Otto Marmet | do | 149.5 | 24.0 | 4.8 | 135.20 |
| Convoy | do | 146.0 | 26.5 | 3.7 | 170.58 |
| Henry De Bus | do | 143.0 | 28.0 | 5.0 | 193.00 |
| Catharine Davis | do | 135.0 | 26.0 | 4.0 | 334.00 |
| Mount Clare | do | 134.5 | 25.8 | 4.8 | 191.36 |
| Lucie Marmet | do | 134.5 | 25.8 | 4.8 | 191.36 |
| Val. P. Collins | do | 132.6 | 24.6 | 4.8 | 119.00 |
| J. B. Lewis | do | 132.0 | 22.0 | 4.5 | 162.00 |
| D. T. Lane | do | 129.6 | 24.1 | 4.0 | 146.94 |
| Douglass Hall | do | 127.5 | 27.2 | 4.3 | 122.00 |
| Crown Hill | do | 127.0 | 19.5 | 4.0 | 120.00 |
| Bill Clark | do | 122.0 | 29.6 | 5.0 | 142.00 |
| Little Bill | do | 122.0 | 23.0 | 4.0 | 110.00 |
| Sea Lion | do | 121.0 | 20.0 | 3.0 | 106.00 |
| John Mackey | do | 120.0 | 23.5 | 3.6 | 124.16 |
| George Gardner | do | 120.0 | 22.0 | 3.6 | 85.00 |
| Albany | do | 120.0 | 21.0 | 2.5 | 98.00 |
| Annie L | do | 115.8 | 20.3 | 3.1 | 114.69 |
| Geo. Matheson | do | 112.0 | 22.0 | 4.0 | 124.06 |
| W. B. Calderwood | do | 112.0 | 24.5 | 4.6 | 85.56 |
| F. A. Goebel | do | 111.3 | 23.0 | 3.0 | 61.00 |

[a] Side-wheel.

[b] Screw propeller.

*List of steamboats plying Kanawha River, West Virginia, etc.*—Continued.

| Name of boat. | Character. | Length. | Breadth. | Depth. | Tonnage. |
|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | |
| Reba Reeves | Towboat | 107.0 | 22.0 | 3.4 | 63.11 |
| Little Clyde | do | 105.0 | 20.0 | 3.0 | 99.00 |
| Mary Stewart | do | 100.0 | 20.0 | 3.2 | 91.00 |
| Nellie England | do | 92.0 | 18.0 | 3.5 | 85.00 |
| N. B. Goble | do | 90.0 | 18.0 | 3.6 | 49.00 |
| Little George | do | 41.0 | 10.0 | 2.8 | 6.00 |
| Bee | U. S. towboat. | 120.0 | 22.0 | 3.6 | 85.00 |
| James Rumsey [a] | do | 120.0 | 22.0 | 4.3 | 125.00 |
| Golden Rod | U.S.L.H.tender. | 150.0 | 26.5 | 3.7 | 143.58 |
| Mascot [a] | U. S. launch | 61.0 | 8.1 | 3.4 | 7.00 |
| Colonel Potter [a] | do | 66.5 | 10.5 | 4.0 | 9.90 |
| Billy Martin [a] | Pump and harbor. | 89.0 | 14.3 | 4.0 | 28.15 |
| Iron Duke [a] | do | 88.0 | 13.5 | 3.7 | 30.63 |
| Madge [a] | Launch | 66.5 | 10.5 | 4.0 | 9.90 |
| Nancy E [a] | do | 35.0 | 6.0 | 4.0 | 3.00 |
| Lucy [a] | do | 28.7 | 6.0 | 3.0 | 2.00 |
| Ruth [a] | do | 25.0 | 5.0 | 4.0 | 2.00 |
| Amelia [a] | do | 25.0 | 5.0 | 4.0 | 2.00 |
| Soncy [a] | do | 18.0 | 5.0 | 3.0 | 1.00 |
| Virgie [a] | do | | | | |
| Swan | do | | | | |
| Gordon Nigh | do | | | | |
| Lizzie D [a] | do | | | | |
| Mountain Boy [a] | do | | | | |
| Janice [a] | do | | | | |
| Bible Mission [b] | do | | | | |
| Lenore [a] | do | | | | |
| Mozena [a] | do | | | | |
| Bird [a] | do | | | | |
| Edith [a] | do | | | | |
| Leonora [a] | do | | | | |
| Viola [a] | do | | | | |
| Prentiss Farley [a] | do | | | | |

[a] Screw propeller.

[b] Side-wheel.

Where no dimensions are given the boats are not registered, being small naphtha or gasoline launches.

## F F 6.

## PRELIMINARY EXAMINATION OF ELK RIVER, WEST VIRGINIA.

[Printed in House Doc. No. 81, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith for transmission to Congress a report dated February 5, 1903, by Capt. W. E. Craighill, Corps of Engineers, on preliminary examination authorized by the river and harbor act approved June 13, 1902, of Elk River, West Virginia, "with a view to open river navigation."

Captain Craighill reports that in his opinion the river is not worthy of improvement as proposed, and in forwarding the report the division engineer, Col. G. J. Lydecker, Corps of Engineers, agrees that the work contemplated is not advisable.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and attention is respectfully invited to the Board's report of April 9, 1903, in third indorsement thereon.

Elk River was under improvement for open-river navigation from 1878 to 1899, and for the reasons given in its report the Board of Engineers expresses the opinion that it is not advisable for the United States to again undertake the improvement of the river by this method. I concur in this opinion.

During the investigation it was developed that certain local interests were in favor of improvement for slack-water navigation; but under the terms of the law as quoted, consideration of this phase of the subject was not deemed permissible.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### REPORT OF CAPT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

United States Engineer Office,
*Wheeling, W. Va., February 5, 1903.*

General: In accordance with instructions conveyed in your letter dated June 23, 1902, I have the honor to submit the following report upon the preliminary examination of Elk River:

Previous examinations of this river have been made as follows:

First. From the mouth to Sutton, a distance of 100 miles, in 1875, by Maj. W. P. Craighill (see Annual Report of the Chief of Engineers for 1876, Part 2, p. 166).

Second. Under direction of the same officer in 1890 (see H. Ex. Doc. No. 103, 51st Cong., 2d sess., and Annual Report of the Chief of Engineers for 1891, Part 4, p. 2434).

Third. By Capt. H. F. Hodges (see Annual Report of the Chief of Engineers for 1900, Part 5, p. 3393).

About $30,000 has been spent in improving the river from its mouth to Addison, a distance of 139 miles. The work has consisted in removing obstructions, such as overhanging trees and large stones, and otherwise improving the channels so as to permit of the free passage of logs, push boats, and canoes.

No work was done between 1894 and 1899, and none since 1899.

Since the construction of the railroad to Clay (52.5 miles above the mouth of the river) and the connection of Sutton with the northern part of the State by rail, the traffic on the river by boat has practically ceased and the quantity of timber floated down the stream largely decreased.

The mean low-water flow of the stream was determined by Mr. N. H. Hutton, civil engineer, in 1875, to be 80 cubic feet per second (see Annual Report of the Chief of Engineers for 1876, Part 2, p. 166) and extreme low water, by Mr. Addison M. Scott, civil engineer, in 1894, was estimated to be 19 cubic feet per second. It is probable, however,

**that such extreme low water will not last for more than one month in the year, and it does not occur every year.**

It is only in recent years that the extent of the coal fields tributary to the Elk River has been fully shown. Borings for gas and oil have developed a fine bed of coal on the north side greatly in excess of what was previously supposed to exist. This coal lies about 400 feet below the surface. Natural gas has also been found in large quantities, and a small flow of oil struck.

Several new towns have sprung up along the river, and the population of the old ones increased, the indications being that there will be a considerable development of coal along the river in the near future.

But besides the difficulty due to scarcity of water, the river has in it long and steep shoals and sharp bends, which render impracticable any satisfactory scheme of improvement by open-river navigation.

The only possible method to provide access to the coal fields by the river would be to build locks and dams; but as the terms of the act did not provide for an examination with such a method of improvement in view I have not considered whether or not it would be economically desirable. In my opinion the river is not worthy of improvement with a view to open-river navigation.

A copy of a statement by the Charleston Chamber of Commerce and a blue print[a] showing the Elk River are appended hereto.

Very respectfully,

W. E. CRAIGHILL,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, February 7, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

In my opinion the improvement of this stream with a view to open-river navigation is not advisable.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 17, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

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[a] Not printed.

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 9, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer, the indorsement of the division engineer thereon, and the information acquired by a committee of the Board at a public hearing at Charleston, W. Va.

During the period 1878–1896 $30,500 was appropriated for the Elk River, and this amount has been expended in open-river improvement. Nevertheless there has been no marked increase in commerce; on the contrary, during the latter years of the improvement the amount of water-borne commerce decreased. No interest is manifested in the further improvement of this stream for open-river navigation. There seems to be a desire, however, for a slack-water improvement. Local interests expect that the large coal deposits tributary to the river will seek that outlet to market if it be made available. It is evident from the small discharge and other characteristics of the river that no open-channel improvement can possibly make it useful for the coal trade.

In view of the above the Board expresses the opinion that it is not advisable for the United States to undertake again the improvement of " Elk River [West Virginia] with a view to open river navigation." By the wording of the act ordering the preliminary examination, a slack-water improvement is excluded from consideration by the Board, which expresses no opinion as to the desirability of such work.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

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### LETTER OF THE CHARLESTON (W. VA.) CHAMBER OF COMMERCE.

CHARLESTON CHAMBER OF COMMERCE,
*Charleston, W. Va., October 9, 1902.*

GENTLEMEN: Your special committee appointed in reference to locking and damming the Elk River begs to hand you the following, showing the value of coal property immediately tributary to Elk River.

Yours, very truly,

F. W. ABNEY, *Chairman.*
GEO. F. COYLE.
J. D. BAINES.

The CHAMBER OF COMMERCE,
*Charleston, W. Va.*

Respectfully referred to Capt. W. E. Craighill, Corps of Engineers, U. S. Army.

CHAS. CAPITO, *President.*
CHAS. LOEB, *Secretary.*

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### THE ELK COAL FIELD AND ITS COALS.

The coals of the Elk field underlie almost the entire watershed of Elk River and its various tributaries. The watershed extends in a northeasterly direction from the point where it joins the watershed of the Kanawha, near Charleston, to the headwaters of the Tygarts Valley and the Cheat rivers, a distance of 180 miles. It attains a maximum width in the vicinity of Blue Creek of 25 miles. This stream is in Kanawha County, and empties into the Elk River 14 miles above Charleston. Ascending the stream from the latter point to Sutton, a distance of 100 miles from its mouth, it will vary in width from 15 to 20 miles. From Sutton to the headwaters, a distance of 50 miles, the shed or field narrows to a width of 10 to 12 miles. Elk River flows longitudinally through this shed in a southeasterly direction, lying on the lower side of the shed from the source of the main stream to about the town of Addison. From this point the river crosses the shed on its course to Sutton, from which point it lies and flows along the upper portion of the shed to its junction with the Kanawha at Charleston.

The dip of the strata from Charleston to a point near Sutton is almost at right angles with the stream, the latter lying almost on the "strike" of the strata. Ascending the stream from Sutton to Addison, the dip of the strata is practically with the flow of the stream. Between Addison and the headwaters of the stream, or the "divide" between the Elk shed and the Tygarts Valley, the river flows about as over the first section, nearly on the "strike" of the strata. Between Sutton and Charleston, or the first section of the field referred to, the river practically flows and has its bed in the strata, dividing the middle or Kanawha measures from the upper measures.

The tributaries entering the river from the south practically flow in the direction of the dip. The descent of these tributaries, as they cut through the various formations, is not as rapid or as great as the dip of the strata. This condition prevails practically between Charleston and Addison.

The upper measures, or those bearing the upper coals, appear in the immediate vicinity of the river as the river lies at their base, while the various strata of the middle or Kanawha measures, bearing the various seams of these measures appear above the water level as you ascend the streams to the right or in a southeasterly direction.

Comprehensively speaking, you may say that all of the Kanawha coals appear in fine workable condition in this coal basin. In addition to the Kanawha coals, properly speaking, there is a very superior cannel coal on Mill Creek and on Falling Rock Creek of Elk River. Both of these cannel coals are now operated, and the coal both from the Mill Creek operation and the Falling Rock Creek operation find ready sale in the markets of the East, North, and West. We will not particularize by mentioning the coals found on the different creeks except to say that on Blue Creek, a tributary entering the river 12 miles above Charleston, the lower coals of the upper measures and the upper coals of the middle measures of workable thickness and superior quality appear above the drainage of the stream, as shown from the numerous exposures or openings. We mention this to show that ascending the river valley from Blue Creek, at the point where it is joined by the valley of Birch River, 18 miles below Sutton, the same conditions practically prevail as regards the coals in their dip or inclination.

On Birch River all of the coal seams of the Kanawha measures, down to and including the Clarion or Wyant seam, appear above the drainage of the stream, as shown by numerous openings, including in their list the finest bituminous, splint, and coking coal of these measures. The coals of the upper measures, including the No. 5, the North Coalburg or Brush Creek, and other seams above the latter appear in large areas. These are usually high-grade splint coals. The coal seams along this stream attain, in nearly every instance, workable thickness; in some instances they are of an ideal thickness for working.

On the north side of the Elk, in the vicinity of the river, the seams of the upper measures only appear above the drainage. Recent borings of this territory show the Pittsburg seams at a fine workable thickness and of superior quality in the vicinity of Big Otter and O'Briens Creek. The Pittsburg seam attains a thickness of between 5 and 6 feet on the north side of the river in the vicinity of Frametown, and from 4 to 6 feet at Big Otter and O'Briens Creek. These last streams would be reached by the river improvement to Clay.

In the section of the watershed or coal field between Sutton and Addison, the river crosses, as mentioned heretofore, from its southerly to its northerly position in the basin, flowing practically with the dip of the strata and cutting through the formations of the middle or Kanawha measures and the upper portions of the New River measures, cutting through the great conglomerate or Falls Rock or Rogers No. XII at a point 17 miles above Sutton, bringing the strata bearing the New River coals above the drainage from the latter point to the head of the stream.

The first or upper seam of the New River coals, known as the "Nuttalburg," appears at a point 2½ miles above Addison and extends 16 to 18 miles farther up the stream at an elevation of between 400 to 500 feet above the water surface of the river. This seam, which is the very finest coking coal, attains a thickness of from 5 to 5½ feet.

Returning again to the section of the stream between Sutton and Addison, we find in the northern portion of this section, the upper coals of the Kanawha measures, notably the "Lewiston" and "Coalburg" seams of coal, attaining nice workable thickness and quality over large areas.

We wish to say in effect that on the river front, as well as on each one of the large creeks from Mill Creek, 7 miles above the mouth of the river, to the head of the river, are found splendid deposits of these coals. The creeks, in almost every instance, are easy of access by railroad or tramroad, and the coals mined thereon can, in almost every instance, be conveyed to the river in the most economical manner and dumped into the barges. Out of this estimate has been largely omitted the great Roane County field, where at 400 feet the Pittsburg vein shows a splendid development. Recent developments by drill on Big Buffalo Creek and O'Briens Creek, both of which can be easily reached by water transportation, show splendid developments of the Pittsburg seam and of the lower beds at less than 100 feet below the surface.

The actual operations of producing coal on Elk River, by reason of want of transportation, are comparatively small. As you ascend the valley of the Elk from Charleston, the first operation is the Mill Creek Cannel Coal Company, which has been mentioned above; the next is the operation of mining the splint coals at Masons, 7½ miles above Charleston. This is the No. 5 of Kanawha valley, and has a thickness, including partings, of 5 or 6 feet. Above this on Falling Rock Creek, 17 miles above Charleston, is the Falling Rock Cannel Coal Company, of which mention has been made above.

At Morris Creek and also Queen shoals in the first section of the basin described, a bed or seam of coal, known as the North Coalburg in the upper measures, is being extensively mined and shipped to the markets of the north and west, where as a fine domestic coal it is in great demand. It is also valued highly as a steam coal. The analysis of the coals from this bed show about 26 to 28 per cent of fixed carbon. The coal yields about 1,200 pounds of coke to the ton (2,000) pounds of coal mined, which is about the average yield of the latter product from the Kanawha coals. Preparations are being made for the mining of coals from Falling Rock Creek, and this extensive operation has only been delayed for the want of transportation facilities. From the valley of Big Sandy, 20 miles above Charleston, to the head of the river on the western side of the Elk River, there are splendid deposits of steam, domestic, and gas coals, which it is not possible to touch by reason of the railroad not being on that side of the river. The total area of the Elk River shed is approximately 2,800 square miles.

In many instances, by reason of railroads to the river, coals can be mined beyond the area of this watershed. The approximate area of this shed from Charleston to Sutton is 1,700 square miles, and its area from Charleston to Big Otter, 12 miles above Clay, is practically 1,100 square miles, or about 690,000 square acres, over all of which territory the coal-bearing strata extends. In estimating the probable amount of coal area it is customary to allow for erosion about one-third of the area. Deducting, however, 50 per cent for erosion, there would remain as a safe estimate practically 350,000 acres of coal immediately tributary to the stream in the section between Charleston and Clay. This practically takes into consideration only the coals above the surface.

In addition to the coals within the limit of this bed there is one of the largest bodies of uncut timber in the State. The Mahoning sandstone, which appears of splendid quality throughout the Elk basin, is considered the finest quality of building stone found in this country. It is superior to any other in this section in color and quality.

## F F 7.

## PRELIMINARY EXAMINATION AND SURVEY OF KANAWHA RIVER, WEST VIRGINIA, FROM LOCK NO. 2 TO THE FALLS.

[Printed in House Doc. No. 305, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 16, 1903.*

Sir: I have the honor to submit herewith reports dated February 6 and November 21, 1903, by Capt. W. E. Craighill and Maj. Geo. A. Zinn, Corps of Engineers, on preliminary examination and survey, respectively, of "Big Kanawha River from Lock No. 2 to the Falls," West Virginia, authorized by the river and harbor act approved June 13, 1902.

In his report on preliminary examination Captain Craighill expresses the opinion, which is concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, that this part of the river is worthy of improvement by the General Government, and the survey was made in accordance with their recommendation. Major Zinn presents in his report on survey a plan for improvement of this part of the river with a view to extending existing slack-water navigation up to the Falls by the construction of two locks and dams, at an estimated cost of $1,777,730. In his opinion the commercial interests, mainly prospective, justify the improvement.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, under the provisions of sections 3 and 14 of the above-mentioned act, and attention is invited to its reports of April 9 and December 9, 1903, thereon. The Board concludes in its report of December 9, that the large cost involved in its accomplishment outweighs the benefits to be expected from extending the slack-water system the short distance of 4½ miles, and it is therefore of opinion that at the present time it is not desirable for the United States to undertake this improvement.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF KANAWHA RIVER, WEST VIRGINIA, FROM LOCK NO. 2 TO THE FALLS.

UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., February 6, 1903.*

GENERAL: In accordance with instructions conveyed in your letter of June 23, 1902, I have the honor to submit the following report upon the preliminary examination of the Kanawha River above Lock No. 2.

Lock No. 2 is situated 85 miles above the mouth of the river and 10 miles below Kanawha Falls, near the head of the river. The head of the pool, formed by Dam No. 2, is about 4.5 miles below the Falls, and it is this stretch of the river, between the pool and the Falls, which is the subject of the present examination.

The improvement of the remainder of the river has been completed by a system of ten locks and dams, the upper two dams (numbered 2 and 3) being fixed dams of crib work, filled with stone, and the remaining eight movable dams of the Chanoine type.

The original project included three fixed dams, each of 15 feet lift, at the upper end of the series, designed to carry navigation to Kanawha Falls; but it was decided later to reduce the lift of the lower two of the three to 12 feet each, and to abandon the improvement of that part of the river above pool No. 2 until the future development of business should show the necessity for it. The reduction of the height of Dams Nos. 2 and 3 has left a fall of about 20 feet above pool No. 2, probably requiring two locks and dams to overcome it instead of one, as at first contemplated.

Above the head of pool No. 2 there are two extensive shoals: First, Loup Creek shoal, about 2 miles long; and second, Long shoal, about 1 mile long. Between Loup Creek shoal and Long shoal there is a pool about a mile in length, and above Long shoal is the Falls basin, a deep pool extending to the foot of the Falls. The river bank on either side is steep, with little or no bottom land between the river and the mountains which inclose it on either hand.

There is no commerce on this part of the river, and there has been no commercial development above the head of pool No. 2, except the establishment of a large power plant at the Falls for the manufacture of aluminum and chromium, and for other purposes. A coal mine has been opened above the Falls, and it is stated that should the improvement of the river to the Falls be provided for, a water-power plant would be established below the mouth of the Gauley River, a short distance above Kanawha Falls.

There is a large area of coal land on the left bank of the river below the Falls said to contain about 23,000 acres. This has been undeveloped in the past because the property belonged to an estate, to speculators, etc.

The indications are that a considerable commercial development may be expected immediately below Kanawha Falls. There is, however, a railroad on each bank. On account of the steep slope of the river the cost of its improvement per mile will probably be great.

If further investigation, based upon an accurate survey, should show this cost not to be excessive, I am of the opinion that this part of the river is worthy of improvement by the General Government, and recommend that such a survey be made at an estimated cost of $1,200.

An extract from the report of Mr. Thomas E. Jeffries, assistant engineer, in charge of the Kanawha River, is appended hereto. It contains much information concerning the commercial value of this part of the river.

Very respectfully,

W. E. CRAIGHILL,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, February 7, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in Captain Craighill's opinion that this part of the river is worthy of improvement, and in his recommendation for a survey.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 16, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 9, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer, the indorsement of the division engineer thereon, and has by a committee made a personal inspection of the locality, and held a public hearing at Charleston, W. Va.

This river has been improved by the United States from its mouth to within 4½ miles of Kanawha Falls, a distance of 90 miles, by a system of 10 locks and dams. The original project contemplated an improvement to the foot of the Falls. A large and general commerce has developed as a result of the work, the coal trade being the dominant item.

The consideration of this case is complicated by the presence of The Willson Aluminum Company's works at Kanawha Falls, W. Va. This company owns certain water rights which might be affected by the improvement of the river, but desires slack-water navigation to its works, and suggests that the same be provided by the construction of two low dams with locks and by dredging through the first shoal below the Falls, thus giving navigable depth without decreasing the water power.

The Board is of the opinion that this improvement is a worthy one to be undertaken by the United States, provided a survey and estimate of cost shall show that the improvement can be accomplished at reasonable cost and without such injury to the rights of The Willson Aluminum Company, or others, as would result in claims for damages. The Board, therefore, recommends that there be made an allotment of $1,200 for a survey and estimate of cost as recommended by the district officer.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 16, 1903.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of "Big Kanawha River from Lock No. 2 to the Falls," West Virginia, authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,
*April 18, 1903.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 28, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey with estimate as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 9, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

In third indorsement hereon, the Board of Engineers for Rivers and Harbors expressed the opinion that "Big Kanawha River from Lock No. 2 to the Falls" is worthy of improvement, provided such improvement can be accomplished at reasonable cost and without injury to the rights of The Willson Aluminum Company, or others, and recommended that a survey and estimate of cost be made. At its session of this date the Board had before it the report in this survey, with plans and estimate of cost.

To improve the stretch of river from the head of the pool formed by Lock No. 2 to the Falls, a distance of 4½ miles, would require two locks and dams and the excavation of a large amount of rock and other material, at an estimated cost of $1,777,730.

There is no commercial development above the head of pool No. 2 except the water-power plant of The Willson Aluminum Company, located at the Falls. Considerable coal tonnage, however, originates in the pool formed by Lock and Dam No. 2. The commercial statistics show that about 99,000 tons passed down through this lock in 1902. It is represented that if the stretch of river under contemplation were improved, large areas of coal land lying adjacent thereto would be developed, and that commercial industries would spring up and utilize the full power of the Kanawha Falls, as well as other falls above. Comparing the length of navigable river in the pool above Lock No. 2 with the stretch now under consideration, it is fair to assume that slack water to the Falls might result in an increased coal tonnage of about 100,000 tons. It appears, also, that the water-borne commerce to be expected from The Willson Aluminum Company would amount to about 24,000 tons per annum. It is apparent that the advantages to result from the proposed improvement are almost entirely prospective. This locality is not devoid of transportation facilities. The Kanawha and Michigan Railroad is located on the right bank, and the Chesapeake and Ohio on the left bank of the Kanawha River.

While it seems probable that a large commerce and the development and utilization of the natural water power at the Falls would follow as a result of the improvement, it is the opinion of the Board that the large cost involved in its accomplishment outweighs the prospective benefits. The Board is therefore of the opinion that at the present time it is not desirable for the United States to undertake the improvement of "Big Kanawha River from Lock No. 2 to the Falls."

For the Board:

A. M. MILLER,
*Lieut. Col., Corps of Engineers,*
*Senior Member Present.*

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### EXTRACT FROM REPORT OF MR. THOS. E. JEFFRIES, ASSISTANT ENGINEER.

I have the honor to submit the following report on the Big Kanawha River from Lock No. 2 to the Falls.

* * * * * * *

While the shipment of coal out of No. 2 pool has not been as great in the past as was perhaps expected, it is thought that the future will show a substantial increase from year to year, as there are several large coal companies operating in this portion of the river, and the indications are that more tipples will be built for river shipment in the near future.

The following is a list of the present coal companies operating in No. 2 pool. Those with a T after them have tipples for shipment by river: W. R. Johnson (T), St. Clair Company, Forest Hill, Coal Valley Mining Company, Kanawha Gas Coal Company (T), Harewood Coal and Coke Company, Boomer Coal and Coke Company, Carver Bros. (Edgewater) (T), Carver Bros. (Eagle), Mount Carbon Company, Limited, Longacre Coal and Coke Company (T), Johnson's Coal Works, Cannelton Coal Company, Great Kanawha Colliery Company (T).

A new company, the Cardiff Coal Company, is about to begin operations in this pool; and the Loup Creek Colliery Company, with $1,000,000 capital, is beginning work on Loup Creek, expecting to make large shipments by water.

The following is the commerce that passed through Lock No. 2 for the calendar year 1901:

| | | |
|---|---|---|
| Coal | bushels | 2,487,270 |
| Coke | tons | 3,500 |
| Lumber | feet B. M. | 284,350 |
| Saw logs | number | 315 |
| Shingles | do | 339,400 |
| Brick | do | 14,200 |
| Salt | barrels | 170 |
| Miscellaneous freight | tons | 6,164 |
| Steamboats | number | 1,364 |
| Loaded barges | do | 184 |
| Empty barges | do | 175 |
| Other craft | do | 44 |
| Passengers | | 10,338 |
| Lockages | | 1,516 |

There is no coal mined between the head of No. 2 pool and Kanawha Falls, but there is a mine operated on the north side of the river just above the Falls, the product of which is shipped by rail. The reason why no mines have been opened along this stretch of the river is fully set forth in a recent letter received from John A. Willson, resident manager of The Willson Aluminum Company, located at Kanawha Falls, from which I quote:

"In reply to your inquiry as to why no coal mines have been opened between the above-mentioned points, I would state that it has not been on account of an absence of coal along the southeast side of the river, but specially on account of speculators owning small parcels of real estate holding the key to the situation.

"Practically all of the coal area on the east and southeast side of the river and extending back from the river, say 2 miles, is controlled by the Loup Creek estate. This property has been sold recently, and its development is now possible and is proposed. It consists of 23,000 acres of land, which is underlaid by two workable seams of coal, namely, the Ansted seam, which runs approximately 6 feet thick and over, and the Eagle seam, which runs in the neighborhood of 5 feet thick. The Ansted seam has an area of 10,000 acres and the Eagle 12,000 acres.

"Upon the usual basis of 1,600 long tons per foot per acre the two seams would yield the following tonnage:

| | Long tons. |
|---|---|
| Ansted seam, 6 feet, 10,000 acres | 96,000,000 |
| Eagle seam, 5 feet, 12,000 acres | 96,000,000 |
| Total | 192,000,000 |

"I am sending you under separate cover a geologic section of New and Kanawha rivers in West Virginia, by Messrs. M. R. Campbell and W. C. Mendenhall, being an extract of the Seventeenth Annual Report of the United States Geological Survey, 1895–96, part second, Economic Geology and Hydrography. You will see by the map in the pocket of this book that the massive Fayette sandstone dips to and below water level at Kanawha Falls and disappears under that level near the mouth of Armstrong Creek. You will note that the stratum immediately underlying the Fayette sandstone, known as the 'Sewell formation,' bears one of the most important coal seams of the Pottsville series on New River. The thickness of this seam varies with the locality from 3 to 5 feet and is mined at Stone Cliff, Thurmond, Beury, East Sewell, Sewell, Caperton, Nutall, Fayette, Elmo, Sunnyside, Gaymont, and other places. It is claimed that this seam disappears just before reaching water level. This can not be true in view of the fact that it is being mined on White Oak Creek, through a shaft 500 vertical feet below the surface of the earth and shows there a thickness varying from 5 to 6 feet (reference, Mr. Samuel Dixon).

"Immediately underlying the Sewell formation is the Raleigh sandstone which is in turn underlaid by the Royal formation which bears what is known as the Fire Creek seam of coal. This seam lies near the top of this stratum and is mined at Quinnimont, Prince, Slater, Alaska, Rush Run, Red Ash, Fire Creek, and at other places.

"According to the above-mentioned geologic section the Fire Creek seam would not be more than 500 vertical feet below the railroad grade at Kanawha Falls and the Sewell seam not more than 300 feet below the same grade.

"Furthermore it is well established that what is known as the No. 2 Gas Coal is 600 feet above grade at this Falls. The No. 1 or Eagle seam is 150 feet below No. 2 seam, the No. 5 or Sewell seam is 750 feet below the No. 2, and the Fire Creek or No. 3 seam is 1,050 feet below the No. 2 Gas Coal seam. Figuring from this basis the Fire Creek seam would be about 450 feet below grade at this Falls and the Sewell 150 feet below same grade.

"It is practicable to haul coal underground approximately 2 miles. Shafts along the river from Deepwater to this Falls would open up in the two last-mentioned seams of coal an area 8 miles long and 4 miles wide. These two seams would measure together at least 7 feet in thickness. The area mentioned above would comprise approximately 20,480 acres. By the formula first mentioned above this area would yield 229,376,000 long tons of coal, all accessible to the river.

"In addition to the above would call your attention to the coal area on the opposite side of the river owned and partially operated by the Kanawha and Hocking Coal and Coke Company.

"The Ansted and Eagle seams above water level and the Sewell and Fire Creek seams below water level would yield at different points along the distance above referred to an aggregate amount of at least 421,376,000 long tons. To remove this in one hundred years would require the handling and transportation of at least 14,045 long tons per day.

"I note from the River Transportations history that 1898 was the best year to that date, 1,089,160 tons having been transported by its waters. That shows an average of 3,630 tons per diem, and being about 6 per cent of the entire production of the State of West Virginia for that year.

"In addition to the foregoing, there is a vast undeveloped coal area in Nicholas County on the upper reaches of the Gauley which needs some outlet to Cincinnati and the West. A coal railway has been proposed in connection with the river in case transportation is brought to the Kanawha Falls.

"In connection with the developments of The Willson Aluminum Company, I would state that their tonnage would be greatly increased in case of a reduced freight rate on ores and other materials, such as lime, sand, coke, etc. The present development with what is contemplated in the near future will require the transportation of at least 2,000 tons of materials per month. With water transportation the value of the water power at Kanawha Falls would be enhanced in value by the opening up of new and varied possibilities for its complete utilization. With cheap transportation from and to the north, northeast, and northwest the transmission to and utilization at the head of navigation of other New River powers in the production of iron and steel and the manufacture of structural shapes, bars, and plates would be assured.

"Wishing that I may be of further service to you in the matter, I am, yours most truly."

The river from the head of No. 2 pool to the Falls has a fall of about 20 feet in a distance of about 4½ miles, the mountains inclosing it on either side, with little, if any, bottom land after the first mile, there being mostly just room enough for the Chesapeake and Ohio Railroad on one side and the Kanawha and Michigan Railway on the other between the river and mountain.

There is no commerce on this part of the river, and there has only been one or two instances when a steamboat went up as high as the Falls, and then only when the water was extremely high.

The proximity of the two railroads to the river and the flooding of lands at places suggest the impropriety of attempting the improvement of the river from the head of No. 2 pool to the Falls with one dam, and the preservation of the valuable water power at the Falls should also be duly considered.

In addition to the water power at Kanawha Falls, now to a limited extent utilized, there are fair prospects of the water power of New River between its junction with the Gauley and Hinton, at the mouth of the Greenbrier River, being brought into immediate use. I have been told by parties claiming to control the river between the mouth of Gauley and Hawks Nest that, with water transportation below Kanawha Falls for raw and finished materials, work on a power plant located near the junction of the Gauley River would be immediately begun.

The importance of connecting these power plants with the markets tributary to the Ohio and Mississippi rivers by slack-water navigation can hardly be overestimated. The difference in cost between transporting the raw materials and manufactured products by railroad and water will in a great measure determine the desirability of improving this stretch of river.

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## SURVEY OF KANAWHA RIVER, WEST VIRGINIA, FROM LOCK NO. 2 TO THE FALLS.

United States Engineer Office,
*Wheeling, W. Va., November 21, 1903.*

General: I have the honor to submit the following report on the survey of the Kanawha River, West Virginia, from Lock No. 2 to the Falls, as directed by letter from your office, dated April 24, 1903, accompanied by four blueprints[a] embodying the results of the survey and proposed plan for the improvement of that section of the river.

The original survey of the river, made in 1880, included the portion lying between Lock No. 2 and the mouth of Loup Creek, and it was, therefore, thought unnecessary to resurvey it. The sheets submitted are in two sections, one showing the survey of 1880 from Lock No. 2 to the head of No. 2 pool, near Nancys Branch, the other showing the survey made during the past summer running down from the Falls and overlapping the survey of 1880.

Owing to the uncertain fluctuations of the river in the early spring, it was deemed advisable not to begin the survey until a more settled condition should be reached. On June 15, 1903, a double set of levels was started from the miter sill of Lock No. 2 to connect with an old low-water bench mark established about 1875 at the Falls, and with a series of low-water bench marks established in the fall of 1900 at various points between the Falls and the head of No. 2 pool. These levels were finished early in June, and the topographical work begun on July 8, 1903.

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[a] Not printed.

The survey party began this work just above the Falls on the left bank of the river, the zero of the base line being 748 feet below the point where the dam of The Willson Aluminum Company connects with that bank. The base line continues along the left bank of the river to station 238 + 60 where it crosses to the right bank, thence along that bank to 276 + 80, thence to the left bank again, where it remains to the end of the survey at station 332.

The lines of soundings are 200 and 400 feet apart, and are believed to be sufficient in number to delineate the river bed in pools and at shoals. Where figures are omitted from a regular line of soundings the river was too deep to reach bottom with a 21-foot pole.

Owing to the proximity of the Chesapeake and Ohio Railroad on the left bank and the Kanawha and Michigan Railroad on the right bank, frequent cross-sections were taken to include the railroads with their approximate elevations. Low ground liable to be flooded by pool water was also cross-sectioned.

As far as practicable, the rock exposed or located in the river bed has been shown on the map by underscoring the soundings in red, although there are doubtless many other places where the deposit is very shallow. The river bed being so full of loose rocks of various sizes at the head of Long shoal, it was impossible to locate the bed rock, but the cost of excavation at this point will undoubtedly approximate very closely to that of solid rock. Borings made at the Falls by private parties, to develop any underlying beds of coal, indicate that the rock is very hard for a depth of 50 feet below the river bed.

Owing to the extremely hot weather and the heavy growth of willows and underbrush along the banks, the survey work was retarded and extended over a longer period than was anticipated.

The difference of elevation between No. 2 pool (597.75) and the Falls basin (618.8) indicates that two locks with an aggregate lift of 20 feet 3 inches will be required to carry the slack water into the Falls basin at an elevation for the upper pool of eight-tenths of a foot below low water, and a greater elevation can not be taken without injuring in some measure the water power of The Willson Aluminum Company, thus defeating the main object of the improvement, which is to provide slack-water navigation at the Falls and the greater development of the water power at that point, now only partially utilized for want of cheap transportation. The elevations of the pools are therefore confined to narrow limits.

The coal tipples already built or under construction, the contour of the banks, and the location of tributary streams prevent as desirable a location of Lock and Dam No. 1, at the upper end of No. 2 pool, as could be wished. The best location that can be found is believed to be at station 312, about midway between the two coal tipples of the Great Kanawha Colliery Company, with the lock on the right bank. With a lower miter-sill elevation of 590.75, or 7 feet below No. 2 pool, the foundation masonry below the top of the sill will consist of about one course of stone. The dam will require a lift of 12 feet 3 inches, for a pool level of 610, and the top of lock walls an elevation of 622.

The second lock and dam above No. 2, designated No. 1 A, should be near station 214, with the lock on the left bank. It may be possible to utilize the large rock on the right bank for an abutment. This rock appears to be the remains of an original ledge, and the appearance of the river bed in front of it indicates that it does not rest on material liable to scour. The rock is well defined at this point for the entire width of the river, and but little expense would be incurred for cofferdams if the lock and dam were constructed during a low-water season. The foundation masonry would be similar to that mentioned for Lock No. 1.

The dam should have a lift of 8 feet, making the pool, as previously stated, eight-tenths of a foot below low-water level in the Falls basin.

With pool elevations of 610 and 618 feet, and a channel 300 feet wide and 7 feet deep, considerable excavation in hard rock would be required. At Wheelers Island it is, however, impossible, except at enormous expense, to secure a width of 300 feet, and 150 feet has been selected for the channel width with a consequent increase in the difficulties of navigation for tows.

The lines upon which the calculations for excavation have been made are shown on the drawings in red. The lock locations are shown in the same manner.

Previous experience on this river shows the desirability of protecting both banks of the river by a revetment of heavy riprap for a distance of three-fourths of a mile below the locks, which revetment should be carried to a height of at least 5 feet above the lock walls.

In order to prevent to some extent the scour along the banks near the dams and to make it possible to govern the height of the pool at the Falls so as not to interfere with the water power at that point, the upper portion of the dams, say for 6 feet in height, should be movable. While this results in a great increase of cost, it will prevent the possibility of suits for damage by flowage, etc., in the future.

The locks should be of the same dimensions as those in the lower part of the Kanawha River, because experience at Locks Nos. 2, 3, and 4 has shown that great delay and an unnecessary number of lockages are caused to coal fleets with barges of 25 feet or more in width.

Gravel and sand are difficult to find in this stretch of the river, and, while concrete may be slightly cheaper, the estimates have been based on the use of cut-stone masonry similar to that used in the other locks on this river.

The following estimate of the cost of carrying slack-water navigation of the Kanawha River from Lock No. 2 to the Falls is based on the above statements and recommendations:

| | |
|---|---|
| Lock and Dam No. 1 A | $538,227 |
| Lock and Dam No. 1 | 525,039 |
| Rock excavation | 598,590 |
| Ordinary excavation (gravel, bowlders, etc.) | 115,874 |
| | 1,777,730 |

Captain Craighill's report and its appendix, from this office, dated February 6, 1903, on the preliminary examination of the Kanawha River from Lock No. 2 to the Falls, gives a general description of the entire river and its commercial situation, to which but little can be added in this report.

There is no doubt that slack-water navigation to the Falls would result in great development, both in the coal fields and in the Falls water power, of which latter only one-third is now utilized. The resulting tonnage would add enormously to that already existing on the Kanawha River, and while the cost of the improvement from Lock No. 2 to the Falls seems very great compared to the length of river to be improved, yet it would not only, as stated in Captain Craighill's report, aid in the development of the coal fields and water powers in that vicinity, but would also, as a minor matter, bring into greater use the navigation facilities already provided on the lower river.

I am of the opinion that the commercial interests connected with this section of the Kanawha River, mainly prospective, however, justify its improvement from Lock No. 2 to the Falls.

The survey of the river from Lock No. 2 to the Falls was made by a party under charge of Mr. Frank Conklin, junior engineer, under the immediate direction of Mr. Thomas E. Jeffries, assistant engineer, upon whose report the above recommendations and estimates are based.

Very respectfully, your obedient servant,

Geo. A. Zinn,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, November 25, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

In view of the high estimated cost of this improvement I doubt the expediency of entering upon it at present. But I have not visited this locality and do not feel qualified, with my present limited knowledge, to express a definite opinion.

G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

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## F F 8.

## PRELIMINARY EXAMINATION OF LITTLE KANAWHA RIVER, WEST VIRGINIA, BETWEEN LOCK NO. 5 AND BURNSVILLE.

[Printed in House Doc. No. 217, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 5, 1903.*

Sir: I have the honor to submit herewith for transmission to Congress report of February 14, 1903, by Capt. W. E. Craighill, Corps of Engineers, on preliminary examination ordered by the river and harbor act approved June 13, 1902, of Little Kanawha River, West Virginia, "with a view of continuing the improvement thereof to Burnsville."

Little Kanawha River lies wholly within the State of West Virginia. It has already been improved by a system of five locks and dams, which are designed to give a 4-foot navigable depth from the mouth of the river at Parkersburg to the neighborhood of Creston, about 48 miles above. Four of these locks and dams are the property of a private corporation—the Little Kanawha Navigation Company—the fifth, and farthest from the mouth of the river, was constructed by the United States.

There is at present in force a project for the improvement of the river above the locks and dams by means of removing bowlders, overhanging trees and other obstructions, and the wording of the act of June 13, 1902, has therefore been construed to mean "with a view of continuing the *slack-water* improvement" to the town of Burnsville. In the opinion of the local officer, Captain Craighill, concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, this portion of the river is worthy of further improvement by the General Government.

This opinion, however, is contingent upon the policy of the United States toward the improvements on the lower river. The act of June 13, 1902, contains a further provision which has for its object an investigation as to the desirability of the purchase by the General Government of the property of the Little Kanawha Navigation Company. Report on this subject is submitted with a separate letter of this date.[a]

The papers in this case were referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of the act of June 13, 1902, and attention is respectfully invited to the Board's report of March 19, 1903, herewith. The Board is of the opinion that until Congress shall have acted on the question of purchase of works owned by the private corporation referred to above, it is not advisable for the United States to extend the improvement of Little Kanawha River to Burnsville by locks and dams, or otherwise to enlarge the existing project.

I concur in the views thus expressed by the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

## REPORT OF CAPT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., February 14, 1903.*

GENERAL: In accordance with instructions conveyed in your letter dated June 23, 1902, I have the honor to submit the following report upon the preliminary examination of the Little Kanawha River:

A report of an examination of this river by Col. W. E. Merrill, Corps of Engineers, United States Army, is to be found in Part 1, page 740, Annual Report of the Chief of Engineers for 1875. Improvements have been made by the construction of four locks with fixed dams belonging to the Little Kanawha Navigation Company, a private corporation, and at a later date by the construction of a similar lock and dam belonging to the United States. The system of five locks and dams affords navigation for four feet draft from the mouth of the river at Parkersburg to the neighborhood of Creston, about 48 miles above.

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[a] Not printed.

As a separate report was ordered by the river and harbor act of June 13, 1902, upon the advisability of the purchase of the rights of the Little Kanawha Navigation Company, the scope of the present report is confined to that part of the river between the Government lock and Burnsville.

In the past, work upon this part of the river has been confined to the removal of snags, bowlders, overhanging trees, etc., small sums having been expended from time to time for this purpose. Navigation upon the lower river, although carried on with rather small boats, has been sufficient in volume to pay a good interest on the Navigation Company's investment. In the absence of railroad facilities the river has been extensively used for the transportation of logs and for local freights.

An extension of the Little Kanawha Railroad, now about to be commenced, will go up the river as far as Burnsville, and will probably take much of the business from the upper river. Above Glenville (about 102 miles above the mouth of the river), there is an extensive area of coal, belonging to the same vein as that shipped from the headwaters of the Monongahela and favorably known as the Pittsburg coal. The Little Kanawha Railroad is to be a part of the Wabash System which will cross the Ohio River near Parkersburg. Doubtless one of the reasons that has caused the selection of this route is the presence of coal of a well-established good quality; and the present examination by the United States resolves itself into a determination as to whether or not it is economically practicable to bring this coal to market by the improvement of the river, giving due consideration to the physical characteristics of the stream.

There can be no question, I think, of the desirability of canalizing the river, so as to cause the head of the upper pool to reach as far as Sand Fork Creek, about 8 miles above Glenville, provided the size of the river will permit works of a sufficient size to be economical in operation. Above Sand Fork Creek the river is so small and crooked, and so much obstructed by bridges, that for the present, at least, the idea of going above that point should be abandoned. It should be considered also that it is possible that the railroad may acquire all or nearly all the coal land, and thus render practically useless any improvement of the river.

From Sand Fork Creek to Lock No. 5 (about 70 miles), the fall in the river is about 1.5 feet to the mile. In this part of the river the extreme low-water discharge probably does not exceed 15 to 20 cubic feet per second. But such low water is rare, and at moderate stages the river has abundance of water. Throughout its course the river flows through a mountainous country. Its banks are generally steep and stable, presenting favorable conditions for the location of locks and dams of high lifts. The character of the country is such that it will probably be only in the far distant future that the mountains are so much denuded of their timber as to prolong the period of extreme low water to any marked extent.

An extract from the report of Mr. Wm. M. Hall, assistant engineer, in local charge of the river, and two blueprints[a] are appended hereto. The extract gives in detail information as to the commerce and physical characteristics of the river.

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[a] Not printed.

In my opinion the river is worthy of improvement, and I recommend that a survey be made, at an estimated cost of $5,000.

The advisability of improving the upper part of the Little Kanawha is, however, a question which depends upon what decision is reached as to the purchase of the locks of the Little Kanawha Navigation Company. Unless they are purchased and enlarged, and the present Government lock enlarged, the improvement of the river above by locks and dams would be useless.

Very respectfully,
W. E. CRAIGHILL,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, March 4, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in Captain Craighill's opinion that the river is worthy of improvement, and in his recommendation that a survey be made.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*March 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 19, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has fully considered the within report of the district officer and the indorsement of the division engineer thereon.

The Little Kanawha River has been improved for a distance of about 48 miles above its mouth by the construction of five locks and dams. The first four were built and are owned by the Little Kanawha Navigation Company; the fifth was built by the United States.

The river and harbor act of June 13, 1902, ordering the preliminary mination, contemplates extending the improvement to Burnsville, 80 miles above Lock No. 5. A project for the improvement of ction of river by open-channel work is now in existence. It is believed, therefore, that the preliminary examination provided for in the act is with a view to the canalization of this section by means of locks and dams, which is the only improvement that would benefit general commerce. The act of June 13, 1902, also contains the following provision:

> Improving Little Kanawha River, West Virginia: For maintenance, one thousand dollars: *Provided*, That an estimate shall be made of the probable cost of each of the four locks and dams in said river not owned by the Government, as well as the present condition of said locks and dams, and the probable cost of repair, if any, required, and the advisability of acquiring the same in the interest of navigation upon said river.

The locks and dams belonging to the Little Kanawha Navigation Company are known to be in very bad condition. The district officer expresses the opinion that in the event of the United States acquiring these locks they should be rebuilt.

The Board is of opinion that until Congress shall have acted on the report called for in the above-quoted item, it is not advisable for the United States to extend the improvement of this river to Burnsville by locks and dams, or otherwise to enlarge the existing project.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

### EXTRACT FROM REPORT OF MR. WM. M. HALL, ASSISTANT ENGINEER.

I have the honor to submit the following report of my examination of the Little Kanawha River with a view of continuing the improvement thereof to Burnsville.

* * * * * * *

*Geographical position.*—The Little Kanawha River lies entirely within the State of West Virginia. It rises on the western slope of Laurel Hill (one of the principal ranges of the Appalachian Mountain system) and flows entirely across Braxton, Gilmer, Calhoun, Wirt, and Wood counties into the Ohio River at Parkersburg, 184 miles by river from Pittsburg. The general direction of the river from its source to its mouth is very direct, and its general course is about 28 degrees north of west. The entire length of the river from its source to its mouth is about 158 miles; the distance from Burnsville to the mouth, as per survey made by Mr. C. Crozet, State engineer of Virginia, as cited by Assistant Engineer Carpenter in his report of December 31, 1874, referred to below, is 120½ miles.

*Examination.*—During a very low stage of water, from November 18 to 22, inclusive, 1902, I made a trip along the river from the Government lock, near Burning Springs to Burnsville, a distance of 80 miles. I rode along the bank of the river nearly all the way and thereby was enabled to see the bed of the river, the nature of its banks, the valleys, hills, cultivated fields, residences and other buildings, the villages and towns, coal openings, stone, timber, and other natural resources. The principal towns and villages on its banks are Burnsville, where it is crossed by a branch of the Baltimore and Ohio Railroad, and which is the present head of boat navigation; Sand Fork, at the mouth of a creek by that name on which there is a large oil development; Glenville, the county seat of Gilmer County; Grantsville, the county seat of Calhoun County; Brooksville, at the mouth of Yellow Creek, on which there are numerous oil wells; Creston, at the mouth of the west fork of Little Kanawha River and about one mile below the head of slack-water navigation; Burning Springs, where the first oil in West Virginia was discovered, about forty-three years ago; Elizabeth, the county seat of Wirt County; and Parkersburg, at the mouth, which, with its suburbs, now has a population of about 20,000.

*Former surveys.*—In his report (1874) Mr. Carpenter writes as follows:

"A survey of the river was made in 1838 by Mr. C. Crozet, then engineer of the Virginia board of public works. I have succeeded in getting a tracing of the map made from this survey and a copy of it accompanies this report."

I, therefore, suppose Mr. Crozet's survey was the first work of the kind on the river and that there was no other between that and the survey made by Mr. Carpenter.

Mr. Carpenter writes as follows in reference to the levels run:

"As the Little Kanawha Navigation Company had run a line of levels from Parkersburg to Nettle Run, I proceeded to the latter point and continued it to Bulltown."

*Past improvements.*—Natural oil having been discovered at Burning Springs in 1860, which produced a considerable amount of traffic from that point to the mouth of the river, the Little Kanawha Navigation Company was formed and commenced the improvement of the river by four locks and dams in 1867, and completed them in December, 1874, thereby extending slack water several miles above Burning Springs. Mr. Carpenter's report of December 31, 1874, referring to this improvement, reads as follows:

"The Little Kanawha Navigation Company has built four locks and dams, making slack water not less than 4 feet at low water, from Parkersburg to Spring Creek, a distance of 43 miles. * * * All the locks and dams seem to be very substantially built. The lock chambers are 143 feet long and 23 feet wide. The dams consist of cribs 10 feet long, built of sawed oak timber 12 inches square, and well bolted together. They are filled with broken stone, and protected on the upper side by a double row of sheet piling."

In 1878 the first appropriation was made for extending navigation by slack water, and in 1884 the actual construction of Lock No. 5 was commenced. That lock and dam was completed in December, 1891, and since that time has been in successful operation. The lock is of sufficient size for passing a boat about 26 feet wide and 125 feet long.

From the completion of Lock and Dam No. 5 to July 30, 1901, or during the past decade, the appropriations amounted to only $2,243, barely sufficient to keep the river clear of drift and to deaden the growing trees which overhang the shore.

*Discharge and volume of water.*—On account of the small allotment for making this report, it was not practicable for me to have the discharge of this stream measured.

Mr. Carpenter, in his report of 1874, writes on this subject as follows:

"I made a few rough gaugings with the following results: At Bull River shoals (about 78 miles above the mouth) the flow was 12.58 cubic feet per second, or water sufficient for about twenty-one lockages, allowing for leakage about 25 per cent of the whole amount."

He evidently means sufficient water for twenty-one lockages per day by the navigation company locks of size given above. From other information received, I believe his gaugings were at an extremely low stage.

The following is an extract from a letter by Recorder A. L. Ball, who worked for six years, 1896 to 1902, as assistant lockmaster at Lock No. 5:

"I was engaged as lockman at United States Lock No. 5, Little Kanawha River, West Virginia. As to time navigation would be stopped in each year on account of insufficiency of water, I believe that if the locks and dams below No. 5 were in good condition there would have been no time during the greater number of these years, and in no year to exceed thirty days."

Lockmaster Cline has indorsed the above letter as follows:

"I will respectfully advise that I have been engaged as foreman and lockmaster at Lock No. 5, Little Kanawha River, since 1891, and that I believe the above statement by Mr. Ball to be correct."

*Physical characteristics.*—The Little Kanawha Valley is about 80 miles long, has an average width between north and south watershed lines of about 32 miles, the extreme width being about 35 miles. The bottom lands along the river, which range from 100 feet or less in width to 1,000 to 2,000 feet in width, are quite fertile, and are the best part of the many farms from the head of the valley to Parkersburg. There are said to be many good farms on the hills back from the river, but much of the land is rough and mountainous, with narrow valleys containing rapidly flowing creeks. The river itself from Burnsville to the head of Pool No. 5 is a succession of short riffles and pools, the former rarely exceeding 300 feet in length and the latter rarely exceeding a half mile in length.

A list of the riffles with their local names, mileage from the mouth, and other characteristics, is given in the Annual Report of the Chief of Engineers for 1875, Part 1, page 743.

By far the worst place in the river and the greatest obstruction to navigation is Mr. Stockert's mill dam at Stouts Mills. It is 4 feet high, and is now a complete barrier to boats. All the merchandise and other freight carried on that part of the river has to be transferred over the dam by hand.

The bars forming the riffles are formed mainly of bowlders, gravel, a little clay and sand, and in several places exposed ledge. There are but few places where the sand is found in large quantities, and shifting sand bars are unknown in this river.

The banks are high, firm, and give good footing for large trees and undergrowth. In the report referred to above, Mr. Carpenter says:

"Below Yellow Creek the bottom lands are seldom less than 35 feet above the river bed. Above this place they are from 6 to 10 feet lower."

Back water from the Ohio River, in 1884, before Lock No. 5 was built, extended about to Creston. The highest water known at Lock No. 5 since it was opened in 1891 is 32 feet above the lower gate sill. Referring to high water above that point, Mr. Carpenter's report of 1874 states as follows:

"At Rices Ripple I found the high-water mark of 1852 to be 38 feet above low water, and that of several rises in the spring of the present year was 23½ feet. At Dekalb the mark of the flood of 1852 was 36 feet above low water, and ordinary rises reach 24 feet. At Lumberport (now Burnsville) the marks of several rises last spring showed a height of 13 feet; and the highest mark that I was able to find showed a rise of 24 feet."

There is but little trouble from caving banks, or from whole trees, root and all, going into the river, as occurs on many of our other rivers. It is a remarkable fact that the Little Kanawha Navigation Company has never had a snag boat in either one of its pools, and that snagging operations have never been among its expenses.

As the banks of this river are high, and as very little farm land would be flooded by high dams, it appears that this fall could be overcome by 8 dams of about 15 feet lift each. Or should it be decided to place the last dam of the improvement just below Sand Fork, and thereby end the slack-water improvement at about Stouts Mills or mouth of Copen Creek, seven dams could probably be made to do this work. It is believed that by careful examination a good natural foundation could be found for most of these locks and dams, and possibly for all of them. On this subject Mr. Carpenter, in 1874, reported as follows:

"The navigation company found rock bottom for all of their dams except one, and, although the rock does not ordinarily appear on the upper river, I am of opinion that the sand or gravel covering is usually of slight depth."

Some of the bends in the river are rather sharp, but I have an abundance of testimony from boat captains and pilots to the effect that, with sufficient depth of water, they can bring out on each trip with a towboat from Glenville from 6 to 8 barges laden with 500 tons each.

This river has an abundance of water at the mouth in its natural state; even at low water there is never any trouble in entering or departing from it into the Ohio.

## RESOURCES.

Nearly all if not the entire drainage basin of the Little Kanawha River is included in the great Appalachian coal field, which extends from Pennsylvania to Alabama. Some of the minerals of greatest economic worth peculiar to this region are well known and are now being worked in this valley. The principal resources known to exist in large and paying quantities other than those of an agricultural nature are timber, sandstone, limestone, brick clays, natural gas, oil, and the Freeport and Pittsburg veins of coal, each of which is from 5 to 7 feet in thickness.

The industrial development of the mineral resources may be said to have just commenced, and it is probable that others will be discovered and put upon our markets as the development continues.

*Timber.*—The valley has been for many years a large producer of poplar, walnut, oak, hickory, and many less valuable timbers. Although the production of timber may fall off, the natural growth will make timber and its products a large source of commerce for many years.

*Sandstone.*—All along the river from Parkersburg to Burnsville there is a great abundance of a coarse-grained sandstone of fair quality that will be suitable for buildings, bridges, coke ovens, and many other purposes as the valley develops. The masonry of the five locks already built on the river is of sandstone taken from quarries near the respective locks—some of them within a stone's throw of the quarries.

Limestone is said to be found in large quantities at a level of several hundred feet above the river and extending from about 10 miles above Parkersburg to above Elizabeth 25 or 30 miles. Its outcrop is a mile to two miles back from the river.

*Oil.*—As stated above, the first oil discovered in West Virginia was at Burning Springs in 1860. There is now a large daily production at that point, from probably 200 to 300 wells. There are also large productions of oil on Hughes River, on Standing Stone Creek, on Yellow Creek, on Sand Fork, and on several of the other tributaries. The number of producing wells has been constantly increasing and will probably increase for many years to come.

*Gas.*—In drilling for oil considerable gas has been found. It is piped to Pittsburg, Parkersburg, and several intermediate towns, and is used for light and heat, and in iron and steel manufacture.

At Grantsville is located the Cabot carbon factory, which is said to have a capacity of about 5,000 pounds of marketable carbon per day.

*Coal.*—In the upper part of the valley there are two great veins of coal outcropping in the hillsides on each side of the river, i. e., the Pittsburg vein, with a thickness of 5 to 7 feet, which extends from Glenville to within two or three miles of Burnsville, a distance of about 18 miles; and the Freeport vein, which outcrops near Bulltown, at which point it is about 7 feet thick.

On my trip over that part of the valley I saw several coal openings which had an excellent appearance. Mr. S. D. Brady, mining engineer, lately employed by the State of West Virginia in the preparation of a map of West Virginia showing its mines and mineral resources, says there are 60,000 acres of merchantable Pittsburg coal vein and 40,000 acres of the Freeport vein. I understand that he means that there are those amounts of each of these veins above water, which can be mined by drifting. In addition there are several thousand acres of the Pittsburg vein below water which can be mined by shallow shafts, and many thousand acres of the Freeport vein below water which can be mined by shafting. The outcrop of the Freeport vein is above Burnsville, the probable head of navigation, and, consequently, all coal from that vein transported by water will have to be mined by shafting. It is a well-known fact that from each foot of thickness for each acre of coal about 1,000 short tons can be shipped, or for each of these Pittsburg and Freeport veins from five to six thousand tons per acre. To be conservative we will assume the smaller quantity. From the above-named report, and other inquiry, I believe there are at least 50,000 acres of Pittsburg coal tributary to the river; and, when shafting is resorted to, there is almost an unlimited acreage of the Freeport vein. However, it is claimed that a large part of this coal has been bought by a local railroad company and will therefore be shipped only by rail. In view of this fact I have made inquiry of two of the most distinguished and best-informed citizens of Glenville, and have obtained from each of them lists of farms carrying the Pittsburg vein which have not been bought by any railway company or other corporation. The smaller of these estimates gives 26,000 acres. Should we, for argument's sake, suppose that only 20,000 acres of each of these coals, the Pittsburg and Freeport, would be moved by water, and that it would go out at the rate of 8,000 tons per day (equal to 250 carloads, or 16 500-ton barge loads), at that rate it would require nearly one hundred years to move it.

It hardly appears necessary to make estimates for more than a century, but I will remark that, by shafting, the quantity of coal accessible to the river can be increased at will, and with the abundance of natural gas in this region mines with shafts can be operated at a very small cost. It should be borne in mind that both the Pittsburg and Freeport coals have been on the market for a long while, and that they are among the best bituminous coals for domestic or steam purposes in the State or in the world.

Coke is one of the most valuable products of bituminous coal. It is mainly produced for commercial purposes from coal having a low percentage of volatile combustible matter and with a high percentage of fixed carbon; a low percentage of ash and sulphur is also desired. Coke is used for many purposes, but its greatest use is for the manufacture of pig iron, and the direct manufacture of steel by the Bessemer process. The Pittsburg coal is not a good coking coal, but the Freeport is first-class for that purpose, and is said to be second only to the Connellsville and Pocahontas, the greatest coking coals in the world.

## PRESENT COMMERCE.

The commerce on this river is divided into two separate parts—that originating at Burnsville and that on the lower part of the river. The latter can fortunately be given with almost absolute accuracy by compiling daily records of the United States lockmaster at Lock No. 5. I have not the compilation for 1902, but for the calendar year 1901 they are as follows:

| Lockages: | |
|---|---|
| Steamboats, going up | 533 |
| Barges and flats, going up | 130 |
| Miscellaneous, going up | 16 |
| Steamboats, going down | 531 |
| Barges and flats, going down | 123 |
| Rafts, going down | 2,123 |
| Miscellaneous, going down | 23 |
| Total number of crafts passed | 3,479 |

The above was further classified as follows:

| | | |
|---|---|---|
| Timber | cubic feet.. | 1,992,000 |
| Lumber | feet B. M.. | 263,650 |
| Railroad ties | number.. | 220,161 |
| Staves | do.... | 600,000 |
| Coal | bushels.. | 10,120 |
| General merchandise | tons.. | 5,294 |
| Passengers | number.. | 6,684 |

It may be well to note here that the Little Kanawha Navigation Company's rate of tolls applied to the above gives a sum of $5,687.14; i. e., if this lock had been owned by the navigation company, instead of the Government, the people using it would have paid the above amount in tolls during the year 1901.

As stated above, there is quite a large amount of navigation on the upper part of the river which never reaches this lock. Some of it is timber, which is converted by local sawmills, and some merchandise, and oil and gas-well and pipe-line supplies, which leave the Baltimore and Ohio Railroad at Burnsville and go down the river on small flatboats into Gilmer and Calhoun counties. The weight of such merchandise and supplies which go down that part of the river yearly is estimated at from 5,000 to 10,000 tons.

It will be seen from the above that the commerce on this river in its unimproved state, and with 40 miles below the part under consideration in this report, throttled by heavy tolls, is quite large; in fact, it is greater than that of many other streams which have received and are yet receiving large congressional appropriations for improvement; and, as will be seen below, the principal source of future commerce for the river is yet untouched.

### PROSPECTIVE COMMERCE.

There is now an extension of the Little Kanawha Railroad being built to Burnsville, at a cost of four or five million dollars, which may be completed within the coming two or three years. When it is completed it will, no doubt, carry much of the merchandise now carried by boats; but the boats which will ply the river will probably regulate the charges for both water and rail transportation. Moreover, as the coal is developed and as the oil and gas developments increase, the population will greatly increase. This may increase the traffic by water as much as that lost by the building of the railroad.

However, regardless of the above traffic, the great reason for improving this river is to carry the coal and coke from the great Pittsburg and Freeport veins by barge transportation. Such transportation is now furnished to only two coal fields in the Ohio valley, or to only two great soft-coal fields in the United States; i. e., the Monongahela River and the Kanawha River fields. Out of these fields there is now going by water some 10,000,000 tons of coal annually, and the price at which that coal is sold greatly affects the price of all the coal sold along the entire Ohio River and along the lower Mississippi to the Gulf. The effects of this river transportation are so great that I have known the retail price of coal in the interior of West Virginia, within 25 miles of the mines, to be $3 per ton; and, at the same time, in Cincinnati, 325 miles from the mines, to be $2 per ton delivered in the consumers' bins. It appears perfectly safe to assume that this river transportation reduces the price of all the coal sold on the Ohio and lower Mississippi by 50 cents per ton, and at times this reduction may be as much as $1 to $1.50. It also appears that there are annually consumed along the Ohio and lower Mississippi from 25,000,000 to 50,000,000 tons of coal. Therefore, it appears that on account of these two river improvements the consumers of coal are saved in that one article alone from $12,000,000 to $50,000,000 per year.

It is a well-known fact that these best coals can be mined and loaded for transportation at 60 cents per ton or less. In the Pocahontas field the mining companies get an average price of about 75 cents per ton from the trust, which markets all of it, and at that price there is a large profit. Having for seven years served the Norfolk and Western Railroad, which transports all the Pocahontas coal, a large part of which time was spent in the Pocahontas field, I feel quite conversant with this question.

The improving of the Little Kanawha River, thereby adding a third field open to free water transportation, would no doubt further reduce the price of coal all along the Ohio and lower Mississippi. Should this reduction be only 10 cents per ton, the annual saving to the consumers of coal will be from $2,000,000 to $5,000,000, much more than the entire improvement of this river will cost.

When this coal field is opened and direct lines of communication are established to Lake Erie for the transportation of lake ore to this part of the Ohio it is probable that the ore, the coke from the Little Kanawha, and the limestone near here will meet in furnaces on the banks of the Ohio near the mouth of the Little Kanawha. At Pittsburg, to make a ton of pig iron requires about 1.65 tons of lake ore, 950 pounds of limestone, and 2,100 pounds of coke. The ore is transported from Lake Superior, the limestone from central Pennsylvania, 150 miles, and the coke from 60 to 75 miles. Here we have the limestone within 20 miles, the coking coal within 100 miles, and the ore will come from the lakes.

In 1896 a Board of Engineers made a report on the question of a 500-ton barge canal from Lake Erie to the Ohio River (see Annual Report of Chief of Engineers for 1896, p. 2975), and from it the route from Cleveland to Marietta appears to be the best, and of the routes considered it is much the cheapest to construct. A bill for the building of a canal by the State of Ohio on that route, as reported upon by that Board, is now being strongly urged before the Ohio State legislature. The distance from the Little Kanawha coal field to Lake Erie, via that route, is 360 miles. It is probable that coal from that field over that route in 500-ton barges can be put in Cleveland, or on Lake Erie, at about $1.45 per ton—about one-half the present price in that region.

### RECOMMENDATIONS.

In conclusion, I respectfully submit the following opinions and recommendations:

1. The only way to secure a sufficient depth of water for purposes of navigation, and especially for that of coal barges, is to extend the canalization of the river by building additional locks and dams.

2. I believe from the reading of the reports of Colonel Merrill and Mr. Carpenter, of nearly thirty years ago, when the oil development had just started, when the gas was unknown, when the coal was open in less than a half dozen places, and the fact that it is a part of the great Pittsburg vein was not thought of, when the Freeport vein and its quality was unknown, even so long ago, with so little positive knowledge of the resources of the valley, I believe from their reports they thought the river worthy of improvement by canalization, and they prepared and submitted estimates for so doing.

3. In consideration of the large amount of definite and favorable information which we now have of the natural resources of this valley, the large prospective tonnage, and the effect that water competition will have on a large railway tonnage which is about starting out of this valley, and which will require hundreds of years to carry out, the reasons for canalizing the river appear to be ten times greater than thirty years ago.

4. In my opinion the present development and well-known wealth of this river basin in oil, gas, coal, and possibly coke production, the development of which has just commenced, will justify the expenditure of a much greater sum of money than will be required to thoroughly canalize this river.

5. On account of the size and number of the barges which will naturally come from the Ohio and Muskingum into the Little Kanawha for coal, I think that such thorough improvement should include the building of locks with a minimum of 6 feet of water on the gate sills and of sufficient size to pass a barge and towboat abreast, or two barges abreast, each 26 feet wide by 136 feet long. This will require a width a little more than double that of the present locks on the lower river and a little greater length. But it is expected when the old navigation company locks are rebuilt, which will be necessary before many more years, that they will be made the same size as the upper locks.

6. The improvement as above recommended, if made without the Government first obtaining control of the 40 miles of river and four locks and dams between Burning Springs and the mouth, would result in only a partial benefit, and the movement of coal in large barges would not be accomplished.

## F F 9.

## ESTIMATE OF PROBABLE COST OF THE LOCKS AND DAMS IN LITTLE KANAWHA RIVER, WEST VIRGINIA, NOT OWNED BY THE UNITED STATES, THE PRESENT CONDITION OF SAID LOCKS AND DAMS, THE COST OF REPAIR REQUIRED, AND THE QUESTION OF ADVISABILITY OF ACQUISITION OF SAME BY THE UNITED STATES.

[Printed in House Doc. No. 309, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 5, 1903.*

Sir: The item of the river and harbor act approved June 13, 1902, making appropriation for improving Little Kanawha River, West Virginia, contains the following condition:

> That an estimate shall be made of the probable cost of each of the four locks and dams in said river not owned by the Government, as well as the present condition of said locks and dams, and the probable cost of repair, if any, required, and the advisability of acquiring the same in the interest of navigation upon said river.

The duty of carrying out this provision of law was assigned to the engineer officer in local charge, and I have now the honor to submit herewith for transmission to Congress report of August 3, 1903, on the subject, by Maj. Geo. A. Zinn, Corps of Engineers.

The four locks and dams referred to are owned by the Little Kanawha Navigation Company, and were built under charter granted by the State of West Virginia. They are now in a dilapidated condition, and if purchased by the United States would have to be thoroughly repaired or rebuilt altogether. In considering the probable cost to the United States at this time the property is regarded as a whole, it being difficult to place a valuation upon each lock and dam.

In the opinion of Major Zinn these works should be acquired by the General Government in the interest of navigation, the dams should be repaired, and the existing locks replaced by larger ones.

In forwarding this report the division engineer, Col. G. J. Lydecker, Corps of Engineers, concurs in the view that it is advisable in the interest of navigation for the United States to purchase the locks and dams, but expresses the belief that the structures should be repaired rather than rebuilt.

The reports of the district officer and the division engineer have been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in section 3 of the act of June 13, 1902, and attention is respectfully invited to the Board's report of November 11, 1903, also herewith. The questions involved have been carefully investigated, representatives of the Board have inspected the company's property, and a public hearing was held at Parkersburg, W. Va.

The Board favors the purchase of the property of the Little Kanawha Navigation Company by the United States, provided it can be secured at a reasonable price, but does not recommend at this time the building of new and larger locks. Its report closes with the following résumé:

> To sum up, the benefits which would follow the purchase of the Little Kanawha Navigation Company's property and franchise, and the repair of their locks and dams would be these: Navigation would be freed from tolls; the period of navigation would be extended; the volume of commerce would be increased, and the United States would have entire control of the stream should occasion arise for extending the improvement to the coal mines. Furthermore, this seems a favorable time and opportunity for acquiring this property. The Board is of opinion that it is desirable for the United States to purchase the property and rights of the Little Kanawha Navigation Company at a cost not to exceed $75,000. The purchase is regarded as

The receipts and expenditures of the company were as follows:

| | |
|---|---|
| Total receipts from toll and bonds | $520,564.58 |
| Received from sale of capital stock | 158,625.00 |
| | 679,189.58 |
| Cost of works | 230,625.28 |
| Current expenses, including taxes and cost of operation | 44,611.90 |
| Lock repairs | 136,941.39 |
| Dividends | 70,288.23 |
| Interest on bonds and indebtedness | 94,151.14 |
| Bonds and bills payable | 102,571.64 |
| | 679,189.58 |

The total capitalization of the company is $20,000 in 5 per cent bonds and $158,625 in capital stock. The stock is held partly as follows:

| | |
|---|---|
| Wirt County, W. Va | $30,000 |
| Wood County, W. Va | 20,000 |
| City of Parkersburg, W. Va | 30,000 |
| | 80,000 |

The bonds and other stock are held in varying amounts by individuals.

The accompanying resolution[a] of the board of directors of the navigation company shows that they will sell their property and franchise to the United States for $235,000. It would be difficult to place a valuation upon each lock and dam.

The tax collectors for Wood and Wirt counties, W. Va., furnish the following information with reference to the property of the navigation company:

| | Assessed value. | Annual tax for 1902. |
|---|---|---|
| Wood County (Locks and Dams Nos. 1 and 2) | $28,830.00 | $484.05 |
| Wirt County (Locks and Dams Nos. 3 and 4) | 35,225.00 | 845.48 |
| Total | 64,055.00 | 1,329.53 |

The authorities of Wood and Wirt counties and the city of Parkersburg, as shown by the inclosed options,[a] agree to sell to the United States their stock, at the rate of 50 cents on the dollar, and there seems to be no reason why the remainder of the stock (49 per cent of the total) should not be purchased at the same price. Or, assuming the bonds to be worth par, the entire amount of stock and bonds should be purchased for $99,312.50, instead of $235,000, the figures given by the board of directors.

The Little Kanawha River lies entirely within the State of West Virginia. It rises on the western slope of Laurel Hill (one of the principal ranges of the Appalachian system), and flows through Braxton, Gilmer, Calhoun, Wirt, and Wood counties into the Ohio River at Parkersburg, 184 miles by river from Pittsburg. Its general direction is about 28° north of west, and its entire length is about 158 miles. The Little Kanawha Valley is about 80 miles long, with an average width of about 32 miles. The bottom lands along the river are quite fertile. The principal resources of the valley are timber, sandstone, limestone, brick clays, natural gas, oil, and the Freeport and Pittsburg ns of coal, each of which is from 5 to 7 feet in thickness. (For d information see Captain Craighill's report[b] of February 14,

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[a] [illegible]l.

House Document No. 217, Fifty-eighth Congress, second session.

1903, on preliminary examination of the Little Kanawha River "with a view of continuing the improvement thereof to Burnsville.")

Lock No. 5, built by the United States, is located 41 miles from the mouth of the river, and is in continuation of the slack-water system controlled by the Little Kanawha Navigation Company. It carries slack-water navigation to Creston, a point about 48 miles from the mouth of the river. Burnsville is the present head of flatboat navigation. The dimensions of Lock No. 5 are as follows: Lift, 12 feet; length of chamber, 145 feet; width of chamber, 26 feet.

While this lock has been out of commission, due to low water in pool No. 4, as mentioned above, it is probable also that during extreme dry seasons there would be an insufficiency of water above. The gauge records at Lock No. 5 for the last ten years do not show the exact condition of water supply, but it is believed that there would not be over thirty days in each year when it would be insufficient for navigation.

Since this lock was opened to navigation in 1891 the yearly tonnage passing through it has varied from 105,212 tons to 244,254, and it is to be noticed that navigation has been suspended each year because of insufficient depth in the pool below, caused by leakage through Dam No. 4 of the navigation company. The number of lockages during the calendar year 1901 through Lock No. 5 was 3,384. The tonnage for 1901 (see Annual Report, Chief of Engineers, 1902, p. 1927) consisted principally of timber, 60,100 tons; railroad ties, 22,373 tons; logs, 28,000 tons; staves, 2,500 tons, out of a total of 122,190 tons. If this tonnage had paid tolls at the rates charged by the Little Kanawha Navigation Company the amount collected would have been about $5,700.

In addition to the tonnage through Lock No. 5 there is considerable navigation in the upper river which does not reach this lock, some of which is timber consumed by local sawmills, and some is merchandise, oil, and gas-well and pipe-line supplies, which leave the Baltimore and Ohio Railroad at Burnsville and go down the river on small flatboats into Gilmer and Calhoun counties.

A large part of the tonnage passing Lock No. 5 goes through the navigation company's locks, but there is a large additional tonnage between Burning Springs and Parkersburg which it is impossible to estimate exactly. A statement made by the secretary and treasurer of the navigation company was to the effect that the annual tolls collected by that company have averaged more than $17,000; and it is to be noted that the navigation company collects tolls on all merchandise passing its dams, whether passing through the locks or over the dams, and whether the locks are in operation or not. Long delays are frequently caused to boats or rafts arriving at the locks by reason of the locks not being in operation, for which owners have no redress.

By an examination of the company's receipts and expenditures it would appear that the tolls have been sufficient to pay the annual expenses, taxes, repairs, dividends on bonds, and perhaps from 2 to 3 per cent interest on the capital stock, or in general terms the capitalized indebtedness of the navigation company yields a dividend of about 10 per cent, of which about 7 per cent is expended in operating and care of their property and the remainder is profit on the investment. It would be difficult to estimate what the future commerce through these locks would be were they made free of tolls, but there would undoubtedly be some increase. The commerce through Lock No. 5 forms no criterion, because much of it is affected by being obliged to pass through the navigation company's locks.

Between Burnsville and Palestine there is no railroad communication, although some grading has already been done for the Little Kanawha Railroad between these points.

I am of the opinion that the United States Government should acquire the property of the Little Kanawha Navigation Company in the interests of navigation.

It may be added to this report that if the property of the Little Kanawha Navigation Company is purchased it would seem important to rebuild the locks rather than to make any extensive repairs upon them. Their width being only 23 feet, they admit only a small class of boats; if the river above Lock No. 5 should be improved and the coal veins opened, special sized coal barges would have to be built to pass the locks.

It is estimated that new locks 140 feet clear length and 54 feet clear width can be built for $110,000 each, and the four dams repaired at $3,000 each, making a total cost of $452,000.

Very respectfully, your obedient servant,

Geo. A. Zinn,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, August 14, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

I have had no opportunity to make a personal examination of this river, but after careful consideration of this and earlier reports I doubt the practicability of establishing an efficient slack-water system on it on account of insufficient low-water flow. Major Lockwood's report of December 1, 1894, to which reference is made within, states:

> The water supply during the summer months is insufficient, as the system now is, to keep the pools full, and, with additional locks and dams, the area of the water surface would be much increased, and loss from evaporation consequently greater than at present; the result would be that the system would become inoperative earlier in the summer than now. If the old dams were made as tight as the present Government dam navigation would last some longer than it does now, but with the system extended and all the dams tight there would be a long time each year when none but the lightest draft boats could run, and times when even such navigation would fail.

Inadequate low-water flow is indicated in the within report also.

By acquiring the Little Kanawha Navigation Company's system and repairing it the present navigable condition would be appreciably improved and navigation would be relieved from the tolls now imposed upon it. For these reasons I concur in Major Zinn's opinion that it is advisable in the interests of navigation for the United States to acquire the four locks and dams of that system.

G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 19, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By order of the Acting Chief of Engineers:

H. F. HODGES,
*Major, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., November 11, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer, the indorsement of the division engineer thereon, and all other data available. On September 25, 1903, through a committee of the Board, there was held at Parkersburg, W. Va., a public hearing, at which interested parties were given opportunity to express their views. On September 26, 1903, the committee inspected the locks and dams of the Little Kanawha Navigation Company.

These locks and dams, four in number, were designed to carry 4 feet of water at pool stages, to a point 41 miles above the mouth of the river. A lock and dam built at this point by the United States, and known as Lock and Dam No. 5, carry 4 feet at pool stage to a point 7 miles farther upstream.

The act calling for the examination on which the within is a report, reads as follows:

> Improving Little Kanawha River, West Virginia: For maintenance, one thousand dollars: *Provided*, That an estimate shall be made of the probable cost of each of the four locks and dams in said river not owned by the Government, as well as the present condition of said locks and dams, and the probable cost of repair, if any, required, and the advisability of acquiring the same in the interest of navigation upon said river.

With respect to the subjects mentioned therein and to certain related subjects, the district officer reports that the total outlay of the Little Kanawha Navigation Company in the construction of their locks and dams is stated by them to have amounted to $230,625.28; that the dams all leak so badly that at low stages of the river the pool surfaces fall below the crests of the dams and navigation is interrupted; that the relation between the height of the lock walls and of the dam crests is such that there is an excessive fall over the dams until the lock walls are flooded to a considerable depth; that the locks are of faulty design and inferior construction, and both walls and gates are in poor repair; that the cost of putting the locks in good condition will be $87,200, and that the company is willing to sell its tangible property and its franchise to take tolls, for $235,000. (This offer is superseded by an offer to sell at a less figure. See below.)

Both the district officer and the division engineer favor the acquisition of the property of the company. The former recommends that the locks, having been acquired, should be pulled down, and new locks

140 feet long in the clear and 54 feet wide be built in their place. The division engineer, on the other hand, recommends that the present locks be repaired.

The capitalization of the Little Kanawha Navigation Company is $20,000 in 5 per cent bonds and $158,625 in capital stock. The district officer points out that 51 per cent of the stock of this company is owned by the counties of Wood and Wirt and the city of Parkersburg, and that they are willing to sell their shares at 50 cents on the dollar. At this rate, and assuming the bonds to be worth par, the entire amount of stock and bonds would be worth $99,312.50. At the public hearing the secretary of the company presented a copy of a resolution passed September 25, 1903, by the board of directors, in which they agreed to recommend to the stockholders that the company "sell its property and franchise to the United States at a sum sufficient to pay all its debts and liabilities and in addition net each stockholder 50 per cent of the face value of the stock." The secretary estimated that the outstanding indebtedness, including $20,000 worth of bonds, would amount to about $33,500. The capital stock at 50 cents on the dollar amounts to $79,311.50. The offer, then, is to sell for about $112,800.

The Board believes that the counties of Wood and Wirt and the city of Parkersburg should donate their stock to the United States free of cost. It will be worth considerable to them to have the United States take over this property and repair and operate it.

Moreover, it is fair to presume that they have already received a fair return for their investment in the shape of increased public wealth. Just what dividends they have received it is difficult to determine. It is known, however, that from 1893 to 1901, inclusive, the city of Parkersburg received dividends of 49 per cent, or an average of 5.3 per cent for these years.

Assuming that these counties and the city of Parkersburg will be content to relinquish their stock without compensation, the above-mentioned sum of $112,800 is reduced to about $72,300, or say $75,000. The Board believes that the sum of $75,000 would fully compensate the private stockholders, as well as extinguish the bonds and satisfy all other indebtedness.

The locks and dams are in a dilapidated condition and need immediate repair. It would seem that during the period (1893–1901) when the company was paying dividends maintenance was neglected. No dividends have been paid since 1901, profits having probably been swallowed up principally in repairing a washout at Lock 1. If this property is not sold to the United States in the near future the company must either expend large sums in repairs or allow the locks to fall to ruin.

The facilities for navigation afforded by the works of the company are very inferior. At low stages navigation ceases entirely, due mainly, as mentioned above, to the leakiness of the dams; again, as the river rises, navigation is impossible for a time just after the locks are drowned out, due to the excessive fall over the dams. The only time when navigation is unobstructed is at high stage, when vessels and rafts pass over the dams. But an "unimproved" river would be equally navigable at such stages. Tolls are charged as well for what passes over the dams as for what passes through the locks, and the right to charge tolls on logs, etc., floated over the dams has been upheld by the courts. As the larger part of the commerce of this stream consists of articles which come out of the upper river, which is navigable at high stages only, it is evident that in their present condition the works of this company add nothing to the navigability of the stream, except at medium stages.

It was apparent at the public hearing that the people of the Little Kanawha Valley are very desirous that the control of this waterway should be assumed by the United States. It was pointed out that this is one of the few streams in this country on which navigation is not free, and the Board agrees that it is desirable that the traffic on the Little Kanawha should be relieved from the tax now imposed upon it.

It was further urged that this stream should be slack-watered to the coal mines at and near Burnsville. In this connection it will be recalled that the river and harbor act of June 13, 1902, required a preliminary examination of the Little Kanawha River, "with a view of continuing the improvement thereof to Burnsville." The Board's report on this examination is dated March 19, 1903. Without expressing any opinion as to what might be desirable in case the United States acquired the property of the Little Kanawha Navigation Company, the Board reported that until Congress acted upon the question of purchasing this property, it was not desirable for the United States to canalize the upper river, or in any way to enlarge the existing project for that portion of the river. The Board believes that there is no economic necessity for the extension of slack water to the mines. However, to put the United States in a position to take up at any time the systematic improvement of the entire river, it would be well for the United States to acquire, at a reasonable price, the property and rights of this company.

The Board believes that the undertaking in which the United States would find itself engaged if it purchased this property would in a little time be a paying one. To the purchase price, $75,000, must be added the cost of necessary repairs, which the district officer estimates at $87,200. At 3 per cent the interest on these sums will be $4,866. Judging from experience at Lock No. 5, the annual expense for operation and maintenance of the five locks and dams will be about $13,000. In other words, the United States is asked to expend about $18,000 a year for a commerce which in average years amounts to about 200,000 tons. Interest on the cost of Lock and Dam 5 is not included in the estimated expenditure. The Board believes that when tolls are remitted and navigation at low stages made possible by repairs and betterments, there will be a considerable increase of commerce upon this stream. Furthermore, the utility of the existing Government lock and dam is wholly dependent upon the condition of the locks and dams below, and full advantage of it can not be taken until the latter are made serviceable.

The Board does not recommend at this time the building of new and larger locks, as proposed by the district officer, but concurs in the opinion of the division engineer that for the present, at least, it will be sufficient to keep the existing locks in repair. When it becomes advisable to extend slack water to the mines it will probably be found desirable to provide 6 feet of water and to build locks of dimensions sufficient to accommodate the standard coal boat. A less extensive improvement would be at a great disadvantage as compared with the facilities afforded by other slack-watered tributaries of the Ohio.

Before such an improvement is begun, however, the adequacy of the stream to supply the required volume of water should be investigated.

To sum up, the benefits which would follow the purchase of the Little Kanawha Navigation Company's property and franchise, and the repair of their locks and dams would be these: Navigation would be freed from tolls; the period of navigation would be extended; the volume of commerce would be increased, and the United States would have entire control of the stream should occasion arise for extending the improvement to the coal mines. Furthermore, this seems a favorable time and opportunity for acquiring this property. The Board is of opinion that it is desirable for the United States to purchase the property and rights of the Little Kanawha Navigation Company at a cost not to exceed $75,000. The purchase is regarded as inadvisable at any greater price. The locks and dams having been acquired, it will be desirable for the United States to repair these locks and dams at a cost of about $88,000. The same act which provides money for the purchase should contain an appropriation of the full amount needed for the repairs, since the locks are in precarious condition and the work of rehabilitation should begin at the earliest practicable moment.

For the Board:

Chas. J. Allen,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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### RATES OF TOLL CHARGED BY THE LITTLE KANAWHA NAVIGATION COMPANY.

Parkersburg, W. Va., *February 4, 1901.*

*Locktenders, Little Kanawha Navigation Company:*

From and after this date you will charge and collect tolls on railroad cross-ties at the rate of 4 cents per mile per hundred instead of 6 cents as heretofore, and on staves 1 cent per mile per thousand instead of 2 cents as heretofore. I append below table of rates from various points:

| | Miles. | Cross-ties per hundred. | Staves per thousand. |
|---|---|---|---|
| Parkersburg | 0 | ........ | ........ |
| Lock No. 1 | 4 | $0.16 | $0.04 |
| Claysville | 7 | .28 | .07 |
| Kanawha | 10 | .40 | .10 |
| Lock No. 2 | 15 | .60 | .15 |
| Mouth Hughes River | 18 | .72 | .18 |
| Greencastle | 20 | .80 | .20 |
| Newark | 20 | .80 | .20 |
| Lock No. 3 | 26 | 1.04 | .26 |
| Elizabeth | 28 | 1.12 | .28 |
| Palestine | 32 | 1.28 | .32 |
| Reedy | 33 | 1.32 | .33 |
| Enterprise | 35 | 1.40 | .35 |
| Long Ripple | 37 | 1.48 | .37 |
| Burning Springs | 40 | 1.60 | .40 |
| Head navigation to Palestine | ........ | .40 | .10 |

By order of Board of Directors.

L. B. Dellicker,
*Superintendent.*

*Rates of toll charged by Little Kanawha Navigation Company*—Continued.

| | |
|---|---|
| Ordinary freight, per mile, per hundred pounds | 1 mill. |
| Railroad cross-ties, per mile, per hundred | 4 cents. |
| Staves, per mile, per thousand | 1 cent. |
| Coal, per bushel, regardless of distance | 1 cent. |
| Passengers, per lock passed through | 5 cents. |
| Lumber, per mile, per thousand feet | 1¼ cents. |
| Round timber, per lockage | $1.50 |
| Square timber, per mile, per thousand feet | 1¼ cents. |
| Steamer, with barge, light, per lock | $1.50 |
| Steamer, light, per lock | 50 cents. |

If toll on steamer's cargo at above schedule of rates amounts to more than 50 cents per lock, then above rates govern.

## F F 10.

## PRELIMINARY EXAMINATION OF NEW RIVER, WEST VIRGINIA, AT ITS CONFLUENCE WITH THE GREENBRIER RIVER.

[Printed in House Doc. No. 176, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith report, dated February 4, 1903, by Capt. W. E. Craighill, Corps of Engineers, on preliminary examination of New River at its confluence with the Greenbrier River, West Virginia, ordered by the river and harbor act of June 13, 1902. Captain Craighill expresses the opinion, which is concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, that the locality is not worthy of improvement by the United States.

The object of this examination and the effect on the water front at Avis, or Upper Hinton, of improvements heretofore made in this stream by the General Government are fully stated in a report, dated May 1, 1903, by the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act. The locality has been personally inspected by a representative of the Board, and in view of the information before it the Board concludes that it is not advisable for the United States to undertake the improvement of New River at its confluence with the Greenbrier.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### REPORT OF CAPT. W. E. CRAIGHILL, CORPS OF ENGINEERS.

United States Engineer Office,
*Wheeling, W. Va., February 4, 1903.*

General: In compliance with instructions contained in your letter dated June 23, 1902, I have the honor to submit the following report upon the examination of New River at its confluence with the Greenbrier River.

From correspondence with those interested in having this examination made it was learned that the object of it was to determine whether or not the improvements made by the United States in the New River at and near the mouth of the Greenbrier in the year 1878 (see Annual Report of the Chief of Engineers for 1879, Part 1, p. 536) have operated to cause the bank of the New River to scour, injuring the town of Avis.

Avis (formally known as Upper Hinton) is immediately above Hinton, W. Va., on the right bank of the New River and a short distance below the mouth of the Greenbrier, which comes into the New River on the side upon which Avis is built.

The work of improvement by the United States in the New River consisted in blasting channels out of the solid rock bottom above and below the mouth of the Greenbrier. The rock excavated was piled on both sides of the channels, the object being to form chutes for flatboat navigation, the chutes being about 50 feet wide and intended to give a depth of 18 inches at low water.

The Greenbrier enters the New River at an acute angle, pointing downstream, and just below the junction there are three low islands, separated from each other and from the point between the two rivers by narrow channels.

Both rivers are mountain torrents, with very steep, rocky beds.

The Greenbrier River rises in the eastern part of West Virginia, while the New River rises in North Carolina and flows thence northward through Virginia into West Virginia. As the two rivers have their sources so widely separated a considerable freshet may occur in one while the other is low. When a rise comes out of New River and none out of the Greenbrier, the New River flood water passes between the islands below the confluence, and when it reaches a height of about 10 feet passes over the islands. The resultant current strikes the shore in front of Avis, and in the past has caused considerable damage. It is claimed by some of the citizens of the town that the direction of the channels cut by the United States tends to throw more of the current against the Avis water front than would otherwise naturally be the case. In the report of the improvement of the New River above referred to the following statement is made, indicating that the erosion of the bank in front of Avis was going on at the time of the commencement of the work of improvement:

> Arrangements for beginning work, the procuring of tools, boats, blasting materials, etc., were made at once, and a force of hands got to work on the shoals between the landing and the foot of Greenbrier shoal on September 7.
>
> Operations were a good deal delayed by the unprecedented rise in the river, which on September 13 reached 20.2 feet above low water at Hinton. At the mouth of Blue Stone River, 5 miles above, its highest point was 23.7 feet above low water. This was from 5 to 6 feet higher than ever known before. It did much damage in the valley. At Upper or Old Hinton, 16 buildings, several of them good frame houses, were carried away. The sawmill of Mills & Co., the only one then in operation in the place, was also seriously damaged.

In view of the statements contained in the preceding quotation and from a personal examination of the ground I am satisfied that the causes of the damage to the town of Avis were in operation before the commencement of the Government work in the New River, and that these works are not responsible for its continuance. As a rule rivers which are subject to freshets are liable to erode their banks after the country is settled and the banks cleared of their trees and underbrush. At many points on the Kanawha, of which the New River is one of the headwaters, this action has taken place and is now going on.

In my opinion the locality is not worthy of improvement by the United States.

Very respectfully,
W. E. CRAIGHILL,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, February 5, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the views and opinion expressed within.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*Februarg 17, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

Previous papers on the subject on file in this office are herewith.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., May 1, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer upon a preliminary examination of "New River [West Virginia] at its confluence with the Greenbrier River," the indorsement of the division engineer thereon, and other data available, including detailed maps showing the extent and character of improvements heretofore made in the vicinity by the United States. On April 7, 1903, the locality was inspected and further reported upon by the assistant engineer of the Board.

It appears that the object of the preliminary examination is to determine whether or not certain works of improvement made by the United States in New River in the years 1878–79 have operated to cause the bank of New River to erode in front of the town of Avis, or Upper Hinton. The works referred to consist of a channel blasted through a rocky reef from a point 6,400 feet above Avis to a point 10,000 feet above that town and of deposits of spoil along the sides of said channel. At the time of the inspection of the locality the river was at a 3-foot stage, somewhat below a mid stage, yet even at the lower water the works complained of were not even visible, and produced no apparent effect on the current.

The absence of erosive effects upon the islands below the reef and above Avis, against which the water would impinge if the Government work produced any marked diversion of the current, the remoteness of the Government work from the town of Avis, and the slight effect which could be produced upon the banks by work of such character and limited extent convince the Board that no connection can be traced between the Government work and bank erosion at Avis.

The Board believes that it is not desirable that the United States should undertake the further improvement of "New River at its confluence with the Greenbrier River," West Virginia.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

# APPENDIX G G.

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## IMPROVEMENT OF MUSKINGUM RIVER, OHIO; OF GUYANDOT RIVER, WEST VIRGINIA; OF BIG SANDY RIVER AND ITS FORKS, WEST VIRGINIA AND KENTUCKY, AND OF KENTUCKY RIVER, KENTUCKY.

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### *REPORT OF LIEUT. COL. E. H. RUFFNER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

#### IMPROVEMENTS.

1. Muskingum River, Ohio.
2. Operating and care of locks and dams on Muskingum River, Ohio.
3. Guyandot River, West Virginia.
4. Big Sandy River and Levisa and Tug forks, West Virginia and Kentucky.
5. Operating and care of lock and dam (No. 3) on Big Sandy River, West Virginia and Kentucky.
6. Kentucky River, Kentucky.
7. Operating and care of locks and dams on Kentucky River, Kentucky.

#### EXAMINATION.

8. Muskingum River, Ohio, from Zanesville to Coshocton.

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ENGINEER OFFICE, UNITED STATES ARMY,
*Cincinnati, Ohio, July 18, 1904.*

GENERAL: I have the honor to transmit herewith the annual reports of the works under my charge for the fiscal year ending June 30, 1904.

The reports for the Muskingum River have been prepared by Asst. Engineer Edmund Moeser.

The reports for the Guyandot and Big Sandy rivers have been prepared by Asst. Engineer B. F. Thomas.

The report for improving Kentucky River, Kentucky, has been prepared by Asst. Engineer A. M. Campbell.

The report for operating and care of Kentucky River has been prepared by Asst. Engineer John H. Westerfield.

Very respectfully, your obedient servant,

E. H. RUFFNER,
*Lieut. Col., Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

## G G 1.

## IMPROVEMENT OF MUSKINGUM RIVER, OHIO.

At the beginning of the year the unfinished work included in the project as then approved for the application of the balance available from appropriations for this work, was the raising of the crest of Dam No. 9 and building four lock masters' dwellings. The work accomplished during the fiscal year comprised the raising of Dam No. 9 with concrete, the completion of dwellings at Locks 3 and 9, and commencing a dwelling at Lock No. 4.

The work done at Dam 9 consisted in laying 686 cubic yards concrete over the crest of the dam, which is 740 feet long. It was performed by hired labor and the material needed was procured by formal contract. The cost of the work was $3,530.06, being $1,403.94 less than the lowest proposal received for the performance of this work by formal contract.

The lock masters' dwellings built during the year have foundation walls and exterior first-story walls of Portland cement concrete, with all exposed exterior surfaces pick faced. The walls were built by hired labor, and the remainder of the work required to complete the dwellings was done under formal contract. The aggregate cost of the two houses completed during the year, including some filling and grading of the grounds, was $4,186.89.

It is proposed to apply the available balance to the completion of the lock master's dwelling at Lock 4, and to the construction of a house at Lock 7. The application of the additional appropriation recommended is stated in the current summary.

Commercial statistics are reported under the head of "Operating and care," etc.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $11,395.14 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 8,169.47 |
| July 1, 1904, balance unexpended | 3,225.67 |
| July 1, 1904, outstanding liabilities | 186.82 |
| July 1, 1904, balance available | 3,038.85 |
| July 1, 1904, amount covered by uncompleted contracts | 1,347.87 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897. | 8,000.00 |

APPROPRIATIONS.

| | |
|---|---|
| August 11, 1888 | $102,000.00 |
| July 1, 1898 | 6,000.00 |
| June 13, 1902 | 10,300.00 |
| Received from sale of property | 192.07 |
| Total | 118,492.07 |

## ABSTRACT OF CONTRACTS IN FORCE ON MUSKINGUM RIVER DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for furnishing about 700 barrels Portland cement for raising crest of Dam No. 9, Muskingum River, Ohio.*

Name of contractor: Cayuga Lake Cement Company.
Date of approval: July 25, 1903.
Date of beginning and date of expiration: One hundred barrels to be delivered on or before August 23, 1903, and 100 barrels to be delivered every eight days thereafter until completion of contract.

| Item. | Contract price (unit rate per barrel in cotton bags). |
|---|---|
| Portland cement, Cayuga brand (630 barrels, minimum; 910 barrels, maximum), delivered f. o. b. cars at Philo, Ohio | $2.85 |
| Rebate allowed on empty bags returned ... per bag.. | .10 |

Completed.

*Contract for building one lock master's dwelling at Lock No. 3, Muskingum River, Ohio*

Name of contractor: Rechsteiner Brothers.
Date of approval: August 24, 1903.
Date of beginning: September 16, 1903.
Date of expiration: Ninety fair working days from date of beginning, allowing a suspension of work from December 31, 1903, to April 1, 1904.

| Item. | Contract price. |
|---|---|
| Building 1 lock master's dwelling, except the concrete foundation and first-story walls, at Lock No. 3, Muskingum River, Ohio | $1,592.20 |

Completed.

*Contract for building one lock master's dwelling at Lock No. 9, Muskingum River, Ohio.*

Name of contractor: C. O. Waxler.
Date of approval: August 26, 1903.
Date of beginning: September 18, 1903.
Date of expiration: Ninety fair working days from date of beginning, allowing a suspension of work from December 31, 1903, to April 1, 1904.

| Item. | Contract price. |
|---|---|
| Building 1 lock master's dwelling, except the concrete foundation and first-story walls, at Lock No. 9, Muskingum River, Ohio | $1,137.00 |

Completed.

*Contract for furnishing about 340 barrels Portland cement for use in building lock master's houses on Muskingum River, Ohio.*

Name of contractor: Castalia Portland Cement Company.
Date of approval: August 29, 1903.
Date of beginning and date of expiration: One hundred barrels to be delivered on or before September 23, 1903, and 80 barrels to be delivered every ten days thereafter until completion of the contract.

| Item. | Contract price (unit rate per barrel in cotton bags). |
|---|---|
| Portland cement, Tiger brand (306 barrels minimum: 442 barrels maximum), delivered f. o. b. cars at Malta, Ohio | $2.20 |
| Rebate allowed on empty bags returned ... per bag.. | .10 |

Completed.

*Contract for building one lockmaster's dwelling at Lock No. 4, Muskingum River, Ohio.*

Name of contractor: Rechsteiner Brothers.
Date of approval: June, 30, 1904.
Date of beginning: On or before July 22, 1904.
Date of expiration: Ninety fair working days from date of beginning.

| Item. | Contract price. |
|---|---|
| Building 1 lockmaster's dwelling, except the concrete foundation and first-story walls, at Lock No. 4, Muskingum River, Ohio | $1,347.87 |

## G G 2.

## OPERATING AND CARE OF LOCKS AND DAMS ON MUSKINGUM RIVER, OHIO.

This river has 10 locks with fixed dams, which, with their appurtenances, are maintained under the indefinite appropriation for operating and care of canals and other works of navigation.

During the past year the system has been operated and kept in repair, and four of the lateral canals, aggregating 2½ miles in length, have been maintained in navigable condition. The canal at Taylorsville, 1 mile long, which is not now required for navigation, has been kept open to furnish water power.

The past winter was a very severe one, navigation being suspended on account of ice for a period of ninety-one days. There was no suspension of navigation on account of accident.

The following is a summary of the work, in addition to ordinary maneuvering of the locks and care of property, which was done at the different parts of the system during the year:

*At Lock No. 1, Marietta.* Replaced broken fixtures of the turbine machinery and apparatus used for operating the lock gates. Labor was frequently required during the past winter to clear ice, drift, and sediment from the lock and grounds, and to make minor repairs to the lock and lock houses.

*At Lock No. 2, Devols.*—Rebuilt the top of the guide crib in the upper approach to the lock. The renewed portion of crib is 5 feet by 12 feet in cross section and 100 feet in length. Resheated the lower apron of the dam for 50 feet of its length.

*At Lock No. 3, Lowell.* Built a crib extension to the right abutment of dam 100 feet in length for protection of the embankment back of the abutment. Reconstructed a crib below the left abutment of dam 10 feet by 12 feet in cross section and 34 feet long. Navigable depths were maintained in the canal, which is 4,740 feet long, by dredging and flushing out sedimentary deposits. Refilled and shaped up 20 feet of eroded canal embankment and repaired the foundation of the storehouse and waiting room.

*At Lock No. 4, Beverly.*—Replaced the stone backing of the dam where necessary. Renewed the fender planking and prepared timbers for repair of the guard gates. Refilled holes in the earth embankment over conduit to mill race, and cleared many drift piles from the canal and mill race.

*At Lock No. 5, Luke Chute.*—Rebuilt both leaves of the lower gates of lock above the normal level of pool. Reconstructed the guide crib in the upper approach to lock, 12 feet by 12 feet in cross section and 68 feet in length. Repaired coping of lock wall and gate fixtures damaged by ice, and employed labor at intervals to assist in the removal of drift and sedimentary deposits from the lock.

*At Lock No. 6, Stockport.*—Reconstructed both leaves of the lower gates of lock. Rebuilt the top of the guide crib in the lower approach to lock, the portion renewed being 6 feet by 12 feet in cross section and 195 feet long. Refastened one of the filling-valve stems of lock and removed trash from around the valve after placing a coffer across the recess.

*At Lock No. 7, McConnelsville.*—Under contract with E. J. Landor, approved October 17, 1902, a section of the old wooden step dam, 114 feet in length, was replaced with a Portland cement concrete slope, thereby completing the renovation of this dam. The following is the amount of material expended in the work during the past year:

| | | |
|---|---|---|
| Excavation in the old work | cubic yards.. | 497 |
| Stone filling in crib under lower apron | do.... | 250 |
| Timber in crib under lower apron | feet B. M.. | 13,332 |
| Concrete | cubic yards.. | 928 |

The embankment between canal and river was raised about 2 feet for a distance of 650 feet; 920 cubic yards earth were used in making the fill. The operating apparatus of a drawbridge across the canal was repaired and adjusted and the bridge was repainted. Minor repairs were made to the lock gates.

The locality is used as a central point of storage for Muskingum River property, and has a workshop operated by water power where all lumber and timber required for maintenance is planed and prepared. During the past year a new wood planer was placed in the shop, the turbine machinery used to run it was refitted with bed timbers, pulleys and fixtures of the planer were renewed, and the building was repaired and extended. All timber used in repair of lock gates was dressed and framed; a barge and the hull of a quarter boat were built; the metal work and timber for two dump scows was received and preparations were made for commencing their construction. Lumber was prepared for replacing damaged parts of floating plant.

*At Lock No. 8, Eagleport.*—Reconstructed the upper gates of the lock. Rebuilt 7 feet in height of the guide crib below the land wall of lock, which is 100 feet long. Labor was employed at different times to assist in clearing the lock of ice and sedimentary deposits, to repaint the lock gates, to renew backing of dam, and to repair machinery of lock damaged by floods.

*At Lock No. 9, Taylorsville.*—Reconstructed the dam except its crest for a length of 160 feet. Replaced with new timber four arms and six blocks in the lower gates of lock, and prepared the timbers necessary for the entire renewal of these gates. Repaired the guard gates at head of canal. Renewed the top timbers and raised the guide crib below the river wall of lock. The repaired section of crib is 4 feet by 10 feet and 92 feet long. Built a concrete cross wall 8½ feet high and 26 feet long for protection of terreplein of lock. Refilled the eroded canal banks and a washout in the terreplein of lock with 2,200 cubic yards earth.

*At Lock No. 10, Zanesville.*—Built a concrete revetment 100 feet in length along the left bank of the canal. Repaired platforms at the upper gates of lock and made minor repairs to the lock gates. Employed labor when necessary to assist in clearing drift, ice, and mud deposits from the lock and canal and to mow the canal banks.

The floating plant, consisting of dredge, steamboat, scows, pile driver, barges, etc., was kept in serviceable condition. A barge and the hull of a quarter boat were reconstructed. Work was commenced on the construction of two dump scows, and a clam-shell dredging bucket was received for use as an auxiliary dredging plant in the removal of shoals from locks and canals.

The U. S. dredge *Malta* was usefully employed throughout the working season in dredging out the canals, approaches to locks and channels in pools, and in removing snags and other obstructions. The dredge was attended by the U. S. S. *Vega*.

The following is a statement of the amounts and dates of all allotments for this work:

| | |
|---|---:|
| Appropriated, August 5, 1886 | $20,000.00 |
| Allotted— | |
| July 21, 1887 | 190,000.00 |
| August 13, 1888 | 177,623.00 |
| July 1, 1889 | 232,080,00 |
| July 19, 1890 | 195,665.00 |
| May 28, 1891 | 20,000.00 |
| July 8, 1891 | 155,200.00 |
| November 9, 1891 | 39,980.00 |
| November 24, 1891 | 1,200.00 |
| December 9, 1891 | 1,200.00 |
| January 5, 1892 | 12,241.54 |
| August 3, 1892 | 42,919.47 |
| July 22, 1893 | 52,745.36 |
| Allotted— | |
| July 25, 1894 | $47,157.66 |
| July 12, 1895 | 29,971.20 |
| July 24, 1896 | 41,337.10 |
| July 23, 1897 | 43,527.50 |
| July 23, 1898 | 35,950.58 |
| July 25, 1899 | 44,954.30 |
| October 16, 1899 | 1,500.00 |
| July 14, 1900 | 44,921.96 |
| June 25, 1901 | 38,251.42 |
| July 25, 1902 | 47,576.72 |
| July 10, 1903 | 50,358.37 |
| Total | 1,566,361.18 |

*Special work authorized by act of Congress.*

| | |
|---|---:|
| Allotted— | |
| March 21, 1895, protection wall at Zanesville | $1,651.00 |
| June 17, 1895, pier of railroad bridge at Marietta | 10,449.60 |
| June 17, 1895, pier of county bridge at Taylorsville | 5,834.20 |
| Total | 17,934.80 |

## ABSTRACT OF CONTRACTS IN FORCE, OPERATING AND CARE MUSKINGUM RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for reconstruction of abutments and miter sill for guard gates at head of canal at Lock No. 7, and the repair of about 240 feet in length of Dam No. 7, Muskingum River, Ohio.*

Name of contractor: E. J. Landor.
Date of approval: October 17, 1902.
Date of beginning: November 11, 1902.
Date of expiration: By December 1, or, in case of unusual season, before July 1, 1903. (See par. 61 for details.)

| Item. | | Contract price (unit rate). |
|---|---|---|
| Repair of abutments and miter sill at McConnelsville, Ohio: | | |
| Excavation | cubic yard | $1.00 |
| Earth filling | do | 2.00 |
| Timber | M. feet B. M. | 20.00 |
| Concrete | cubic yard | 8.00 |
| Repairs to Dam No. 7, Muskingum River, Ohio: | | |
| Excavation | cubic yard | .50 |
| Stone filling | do | .60 |
| Timber | M. feet B. M. | 10.00 |
| Concrete | cubic yard | 5.05 |

Completed.

*Contract for furnishing one steam boiler for U. S. dredge Malta, on Muskingum River, Ohio.*

Name of contractor: The Union Machine Company.
Date of approval: March 24, 1903.
Date of beginning and date of expiration: To begin April 7, 1903, and complete within eighty working days thereafter.

| Item. | Contract price. |
|---|---|
| Furnishing and delivering, either at Zanesville or Marietta, Ohio, 1 locomotive type, fire box, steam boiler | $748.00 |

Completed.

*Contract for furnishing timber for repairs on Muskingum River, Ohio.*

Name of contractor: Milton Fouts.
Date of approval: September 22, 1903.
Date of beginning and date of expiration: Lot 1 to be delivered on or before December 25, 1903; lot No. 2 delivery to commence October 10 and be completed December 25, 1903.

| Item. | Contract price (unit rate per M feet). |
|---|---|
| Lot 1 (39,645 feet B. M. timber) | $29.50 |
| Lot 2 (71,067 feet B. M. timber) | 17.65 |

Delivered on the Muskingum River bank convenient for loading on barges at any point between Marietta and Zanesville, Ohio.
Completed.

*Contract for furnishing and delivering f. o. b., cars at Malta, Ohio, one dimension planing machine and one power feed-roll attachment, for use in carpenter shop at Lock No. 7, on Muskingum River, Ohio.*

Name of contractor: The E. A. Kinsey Company.
Date of approval: October 6, 1903.
Date of beginning: October 19, 1903.
Date of expiration: January 7, 1904.

| Item. | Contract price. |
|---|---|
| 1 iron-frame dimension planing machine | $1,[illegible] |
| 1 power-driven feed-roll attachment | [illegible].50 |

Completed.

*Contract for furnishing and delivering f. o. b., cars at Zanesville, Ohio, driftbolts for repairs on Muskingum River, Ohio.*

Name of contractor: New Jersey Foundry and Machine Company.
Date of approval: October 1, 1903.
Date of beginning and date of expiration: Delivery to be made on or before December 6, 1903.

| Item. | Contract price per pound. |
|---|---|
| 1,200 driftbolts, [illegible]-inch square and 15 inches long, with heads | $0.02[illegible] |
| 1,300 driftbolts, [illegible]-inch square and 23 inches long, with heads | |

Completed.

*Contract for furnishing and delivering stone for repairs on the Muskingum River, Ohio.*

Name of contractor: The Muskingum River Stone Company.
Date of approval: November 25, 1903.
Date of beginning and date of expiration: Delivery to be made on or before March 7, 1904.

| Item. | Contract price per cubic yard. |
|---|---|
| 1,000 cubic yards rubblestone | $0.44 |

Completed.

*Contract (emergency) for furnishing and delivering f. o. b. cars at Zanesville, Ohio, one clam-shell dredging bucket for new dredge on the Muskingum River, Ohio.*

Name of contractor: The Hayward Company.
Date of contract: February 29, 1904.
Date of approval: Emergency contract.
Date of beginning and date of expiration: To be completed and delivered not later than July 1, 1904.

| Item. | Contract price. |
|---|---|
| 1 clam-shell dredging bucket | [illegible] |

Completed.

*Contract (emergency) for furnishing and delivering f. o. b. cars at Malta, Ohio, or on boat landing at Zanesville, McConnelsville, or Marietta, Ohio, certain metal work for the construction of two dump scows for use on Muskingum River, Ohio.*

Name of contractor: The Union Machine Company.
Date of contract: April 7, 1904.
Date of approval: Emergency contract.
Date of beginning: April 17, 1904.
Date of expiration: June 9, 1904.

| Item. | Contract price. |
|---|---|
| 29,000 pounds of metal work | $2,227.75 |

Completed.

*Contract (emergency) for furnishing and delivering f. o. b. cars at the mill at Tacoma, Wash., Oregon fir timber for building two dump scows for use on Muskingum River, Ohio.*

Name of contractor: J. G. Newbegin.
Date of contract: April 20, 1904.
Date of approval: Emergency contract.
Date of beginning: April 30, 1904.
Date of expiration: May 20, 1904.

| Item. | Contract price (unit rate per M feet). |
|---|---|
| 44,713 feet B. M. Oregon fir timber, dressed on four sides | $10.90 |

Completed.

*Summary of expenditures for operating and care of locks and dams on Muskingum River, Ohio, for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Office expenses, superintendence, and contingencies | $5,745.55 |
| Labor | 17,237.93 |
| Fuel | 1,025.57 |
| Expenses | 1,454.73 |
| Repairs | 22,881.83 |
| Total | 48,345.61 |

*Detailed statement and cost of dredging on Muskingum River, under the appropriation for operating and care of canals and other works of navigation, indefinite, for the fiscal year ending June 30, 1904.*

| Date. | Locality. | Material excavated. | Total cost. |
|---|---|---|---|
| July | Lowell | 14,070 yards mud, at 4¼ cents | $497.98 |
| | do | 14 dimension stone, at $1 | 14.00 |
| | do | 2 logs, per lot | 3.14 |
| | Stockport | 120 yards gravel, at 14 cents | 16.80 |
| | McConnelsville | 100 yards gravel, at 20 cents | 20.00 |
| August | Eagleport | 2,750 yards mud, at 4 cents | 110.00 |
| | Taylorsville | 12,500 yards sand and gravel, at 3⅔ cents | 458.33 |
| | do | 14 logs, at 60 cents | 8.40 |
| | do | 1 snag | 4.27 |
| | do | 3 stumps, at $1.50 | 4.50 |

*Detailed statement and cost of dredging on Muskingum River*—Continued.

| Date. | Locality. | Material excavated. | Total cost. |
|---|---|---|---|
| September | McConnelsville | 10,650 yards mud, at 4½ cents | $479.25 |
| | do | 1 stump | 8.75 |
| | do | 7 logs, at $1 | 7.00 |
| | do | Boiler placed on dredge | 111.78 |
| October | Zanesville | 2,000 yards sand and gravel, at 3¾ cents | 75.00 |
| | Taylorsville | 80 yards mud, per lot | 11.27 |
| | Stockport | 3,200 yards mud, at 3½ cents | 112.00 |
| | Luke Chute | 900 yards sand, at 4 cents | 36.40 |
| | Beverly | 9,360 yards mud, at 3 cents | 280.80 |
| November | do | 3,685 yards mud, at 4 cents | 147.40 |
| | McConnelsville | 50 yards débris, per lot | 25.00 |
| | do | Abandoned hull of steamer Vega No. 1 | 60.00 |
| | Taylorsville | 2,050 yards mud, at 8 cents | 164.00 |
| | do | Repairs and supplies | 867.67 |
| December | do | 1,350 yards mud, at 12 cents | 162.00 |
| | do | Repairs and supplies | 829.46 |
| January to April | | do | 913.95 |
| April | Zanesville | 500 yards mud, at 12 cents | 60.00 |
| | do | Repairs | 489.79 |
| May | do | 8,230 yards mud, at 7½ cents | 617.25 |
| | do | 12 large stones, at 50 cents | 6.00 |
| | do | 10 logs, at 25 cents | 2.50 |
| | do | 40 feet of cofferdam, per lot | 21.45 |
| | Eagleport | 360 yards sand and gravel, at 5 cents | 18.00 |
| | Devols | 1,500 yards sand, at 4 cents | 60.00 |
| June | do | 5,580 yards sand, at 4¾ cents | 264.60 |
| | Marietta | 7,610 yards mud, at 3½ cents | 266.35 |
| | Lowell | 8,450 yards mud, at 3 cents | 108.50 |
| Total | | | 6,483.59 |

The sum of $4,388.10 for operating U. S. S. *Vega* during the year is not included in the total cost of dredging, but the greater part of that amount was incurred while engaged as tender for the U. S. dredge *Malta*. The increased cost per cubic yard of material removed, due to services of tender, is 4 cents, approximately.

*Muskingum River leases.*

| Location. | Lessee. | Dated. | Expires. |
|---|---|---|---|
| *Year ending April 30, 1904.* | | | |
| Dam No. 1, Marietta | The Phœnix Mill Co.[a] | (a) | (a) |
| Dam No. 2, Devols | Gates & Payne | May 1, 1889 | May 1, 1909 |
| Dam No. 3, Lowell | John A. McClain | May 1, 1890 | May 1, 1910 |
| Do | Rechsteiner Bros | do | Do. |
| Do | do | Nov. 1, 1892 | Nov. 1, 1912 |
| Do | E. W. Sprague, estate | Dec. 2, 1879 | Dec. 15, 1909 |
| Do | First National Bank | June 1, 1900 | Do. |
| Do | E. W. Webster | do | June 1, 1906 |
| Dam No. 4, Beverly | Robbins Bros | May 1, 1889 | May 1, 1909 |
| Do | Langenberg & Abrams | May 1, 1890 | May 1, 1910 |
| Do | T. F. Lowe | do | Do. |
| Do | Village of Beverly | May 1, 1901 | May 1, 1921 |
| Dam No. 6, Stockport | W. H. Phillips | May 1, 1889 | May 1, 1909 |
| Dam No. 7, McConnelsville | E. M. Stanbery | Sept., 1839 | |
| Do | McConnelsville-Malta Electric Co | Nov. 1, 1890 | Nov. 1, 1920 |
| Dam No. 7, Malta | Ohio and Little Kanawha R. R. Co | May 1, 1890 | May 1, 1925 |
| Dam No. 9, Duncans Falls | John Miller | Dec. 31, 1836 | |
| Dam No. 9, Taylorsville | Frazier & Son | do | |
| Dam No. 10, Zanesville | John T. Drone | May 1, 1890 | May 1, 1910 |
| Do | The Zanesville Railway, Light and Power Co. | do | Do. |
| Do | do | May 1, 1899 | May 1, 1909 |
| Do | do | Apr. 30, 1903 | Apr. 30, 1923 |
| Do | Muskingum Coffin Co | May 1, 1890 | May 1, 1910 |
| Do | Zanesville Mantel and Furniture Co | do | Do. |
| Do | T. L. Moorehead | May 1, 1893 | May 1, 1913 |
| Do | Muskingum and Ohio River Transportation Co. (Incorporated). | Mar. 23, 1903 | Nov. 13, 1907 |
| Symmes Creek | Jasper K. McCann | May 1, 1890 | May 1, 1906 |
| *Year ending May 31, 1904.* | | | |
| Dam No. 10, Zanesville | John Blankenbuhler | June 1, 1892 | June 1, 1909 |
| Do | Frederick Abel, estate | do | Do. |

[a] Operating without a lease for the year ending April 30, 1904.

*Leases—water power, land, and rental.*

| Lessee. | Subject. | Cubic feet of water per minute. | Annual rental. | Rebate. | Rents collected. |
|---|---|---|---|---|---|
| Phoenix Mill Co[a] | Water power | 16,086 | (a) | $78.03 | $324.12 |
| Gates & Payne | do | 9,000 | $108.00 | | 108.00 |
| John A. McClain | do | 7,280 | 174.72 | | 174.72 |
| Rechsteiner Bros | do | 4,446 | 106.70 | | 106.70 |
| Do | Land | | 10.00 | | 10.00 |
| E. W. Sprague estate | do | | 5.00 | | 5.00 |
| First National Bank | do | | 10.00 | | 10.00 |
| E. W. Webster | do | | 5.00 | | 5.00 |
| Robbins Bros.[b] | Water power | 1,904 | 100.00 | | |
| Langenberg & Abrams | do | 5,600 | 114.24 | | 114.24 |
| T. F. Lowe | do | 6,033 | 109.80 | | 109.80 |
| Village of Beverly | do | 5,000 | 100.00 | | 100.00 |
| W. H. Phillips[b] | do | 6,390 | 230.04 | | |
| E. M. Stanbery[c] | do | (d) | | | |
| McConnelsville-Malta Electric Co | do | 8,702 | 208.84 | | 208.84 |
| Ohio and Little Kanawha R. R. Co | Land | | 2.50 | | 2.50 |
| John Miller[c] | Water power | (e) | | | |
| Frazier & Son[c] | do | (e) | | | |
| John T. Drone | do | 7,560 | 453.60 | | 453.60 |
| The Zanesville Rwy. Light and Power Co. | do | 6,029 | 361.74 | | 361.74 |
| Do | do | 7,399 | 443.82 | | 443.82 |
| Do | do | 50,309 | 1,760.82 | 1,076.06 | 684.76 |
| Muskingum Coffin Co | do | 4,619 | 207.86 | | 207.86 |
| Zanesville Mantel and Furniture Co | do | 4,794 | 186.96 | | 186.96 |
| T. L. Moorehead | Land | | 25.00 | | 25.00 |
| Muskingum and Ohio River Transportation Co., Inc | do | | 25.00 | | 25.00 |
| Jasper K. McCann | do | | 5.00 | | 5.00 |
| John Blankenbuhler | Water power | 2,700 | 100.00 | | 100.00 |
| Frederick Abel estate | do | 5,200 | 184.50 | | 184.50 |
| Total | | | | | 3,957.16 |

[a] Operating without a lease for the year ending April 30, 1904.
[b] No collection.
[c] Perpetual free lease of water power.
[d] Enough to propel 10 run of 4-foot 5-inch millstones.
[e] Enough to propel 15 run of 4½-foot millstones.

NOTE.—Lease issued under date of January 12, 1904, to William H. Frazier, for water power at Dam No. 9, for a term of twenty years commencing May 1, 1904, and transferred to Charles U. Shryock, under date of May 3, 1904. Lease issued under date of May 9, 1904, to Charles U. Shryock for land at Dam No. 9, for a term of five years commencing May 1, 1904.

## COMMERCIAL STATISTICS.

*Commerce of Muskingum River during the calendar year ending December 31, 1903.*

### LOCK NO. 1.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| January | 4 | | 1 | | 5 | 5 |
| February | 29 | | | 10 | 39 | 39 |
| March | 41 | 4 | 4 | 8 | 57 | 57 |
| April | 66 | 2 | 4 | 13 | 85 | 78 |
| May | 61 | 5 | 5 | | 71 | 68 |
| June | 70 | 7 | 13 | 30 | 120 | 92 |
| July | 73 | 10 | 9 | 2 | 94 | 86 |
| August | 48 | 4 | 14 | | 66 | 61 |
| September | 58 | 2 | 7 | | 67 | 61 |
| October | 60 | 4 | | | 64 | 64 |
| November | 62 | 4 | | | 66 | 62 |
| December | 8 | | | | 8 | 8 |
| Total | 580 | 42 | 57 | 63 | 742 | 671 |

## *Commerce of Muskingum River, etc.*—Continued.

### LOCK NO. 2.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| January | 4 | ........ | 1 | ........ | 5 | 5 |
| February | 29 | 4 | ........ | ........ | 33 | 33 |
| March | 41 | 5 | 2 | ........ | 48 | 46 |
| April | 60 | 5 | 2 | ........ | 67 | 67 |
| May | 68 | 6 | 4 | ........ | 78 | 77 |
| June | 77 | 9 | 5 | ........ | 91 | 90 |
| July | 66 | 4 | 18 | ........ | 88 | 85 |
| August | 46 | 4 | 26 | ........ | 76 | 74 |
| September | 60 | 6 | 13 | ........ | 79 | 78 |
| October | 63 | 4 | 9 | ........ | 76 | 76 |
| November | 59 | 10 | 3 | ........ | 72 | 70 |
| December | 7 | ........ | ........ | ........ | 7 | 7 |
| Total | 580 | 57 | 83 | ........ | 720 | 708 |

### LOCK NO. 3.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| January | 4 | ........ | 1 | ........ | 5 | 5 |
| February | 29 | 4 | ........ | ........ | 33 | 33 |
| March | 41 | 5 | ........ | ........ | 46 | 46 |
| April | 60 | 5 | 4 | ........ | 69 | 67 |
| May | 68 | 6 | 4 | ........ | 78 | 78 |
| June | 75 | 10 | 5 | ........ | 90 | 84 |
| July | 66 | 4 | 18 | ........ | 88 | 85 |
| August | 46 | 5 | 16 | ........ | 67 | 65 |
| September | 60 | 9 | 13 | ........ | 82 | 80 |
| October | 65 | 4 | 7 | ........ | 76 | 76 |
| November | 59 | 10 | ........ | ........ | 69 | 69 |
| December | 5 | ........ | ........ | ........ | 5 | 5 |
| Total | 578 | 62 | 68 | ........ | 708 | 693 |

### LOCK NO. 4.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| January | 2 | ........ | 1 | ........ | 3 | 3 |
| February | 28 | ........ | 2 | ........ | 30 | 30 |
| March | 41 | 4 | 1 | 2 | 48 | 48 |
| April | 60 | 4 | 1 | ........ | 65 | 65 |
| May | 62 | 4 | 6 | 1 | 73 | 70 |
| June | 66 | 6 | 11 | ........ | 83 | 78 |
| July | 69 | 7 | 16 | ........ | 92 | 86 |
| August | 46 | 5 | 14 | ........ | 65 | 65 |
| September | 62 | 9 | 13 | ........ | 84 | 80 |
| October | 69 | 11 | 13 | ........ | 93 | 83 |
| November | 59 | 11 | 2 | ........ | 72 | 71 |
| December | 11 | 5 | ........ | ........ | 16 | 16 |
| Total | 575 | 66 | 80 | 3 | 724 | 695 |

### LOCK NO. 5.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| February | 12 | 2 | 1 | ........ | 15 | 15 |
| March | 17 | 2 | ........ | ........ | 19 | 19 |
| April | 13 | 2 | ........ | ........ | 15 | 15 |
| May | 14 | 4 | 5 | ........ | 23 | 19 |
| June | 19 | 3 | 5 | ........ | 27 | 24 |
| July | 14 | 5 | 8 | ........ | 27 | 23 |
| August | 11 | 3 | 13 | ........ | 27 | 27 |
| September | 6 | 9 | 5 | ........ | 20 | 20 |
| October | 15 | 9 | 4 | ........ | 28 | 28 |
| November | 9 | 8 | 2 | ........ | 19 | 15 |
| December | 1 | ........ | ........ | ........ | 1 | 1 |
| Total | 131 | 47 | 43 | ........ | 221 | 206 |

## *Commerce of Muskingum River, etc.*—Continued.

### LOCK NO. 6.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| February | 12 | 3 | 2 | ........ | 17 | 16 |
| March | 17 | 2 | .......... | ........ | 19 | 19 |
| April | 11 | 2 | .......... | ........ | 13 | 13 |
| May | 14 | 5 | 5 | ........ | 24 | 20 |
| June | 20 | 3 | 9 | ........ | 32 | 29 |
| July | 14 | 7 | 8 | ........ | 29 | 24 |
| August | 18 | 8 | 6 | ........ | 32 | 32 |
| September | 6 | 9 | 4 | ........ | 19 | 15 |
| October | 15 | 7 | 5 | ........ | 27 | 27 |
| November | 12 | 10 | 4 | ........ | 26 | 19 |
| December | 1 | .......... | .......... | ........ | 1 | 1 |
| Total | 140 | 56 | 43 | ........ | 239 | 215 |

### LOCK NO. 7.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| February | 10 | .......... | .......... | ........ | 10 | 10 |
| March | 14 | 2 | .......... | ........ | 16 | 16 |
| April | 11 | 4 | .......... | ........ | 15 | 15 |
| May | 14 | 5 | 6 | ........ | 25 | 21 |
| June | 17 | 5 | 7 | ........ | 29 | 25 |
| July | 16 | 7 | 8 | ........ | 31 | 31 |
| August | 17 | 9 | 5 | ........ | 31 | 31 |
| September | 6 | 9 | 6 | ........ | 21 | 17 |
| October | 15 | 8 | 7 | ........ | 30 | 30 |
| November | 12 | 10 | 3 | ........ | 25 | 18 |
| December | 1 | .......... | .......... | ........ | 1 | 1 |
| Total | 133 | 59 | 42 | ........ | 234 | 215 |

### LOCK NO. 8.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| February | 26 | .......... | .......... | ........ | 26 | 26 |
| March | 39 | 2 | .......... | ........ | 41 | 41 |
| April | 60 | .......... | 2 | ........ | 62 | 62 |
| May | 65 | 4 | 7 | ........ | 76 | 76 |
| June | 65 | 1 | 8 | ........ | 74 | 73 |
| July | 71 | 7 | 8 | ........ | 86 | 82 |
| August | 68 | 11 | 10 | ........ | 89 | 84 |
| September | 66 | 7 | 8 | ........ | 81 | 77 |
| October | 65 | 8 | 7 | ........ | 80 | 80 |
| November | 56 | 9 | 2 | ........ | 67 | 62 |
| December | 1 | .......... | .......... | ........ | 1 | 1 |
| Total | 582 | 49 | 52 | ........ | 683 | 664 |

### LOCK NO. 9.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| February | 26 | .......... | .......... | ........ | 26 | 26 |
| March | 39 | 2 | 2 | ........ | 43 | 43 |
| April | 60 | .......... | 2 | ........ | 62 | 62 |
| May | 65 | 4 | 7 | ........ | 76 | 72 |
| June | 71 | 1 | 12 | ........ | 84 | 80 |
| July | 75 | 4 | 10 | ........ | 89 | 85 |
| August | 83 | 13 | 16 | ........ | 112 | 107 |
| September | 68 | 15 | 8 | ........ | 91 | 85 |
| October | 65 | 12 | 9 | ........ | 86 | 86 |
| November | 58 | 10 | 3 | ........ | 71 | 62 |
| December | 1 | .......... | .......... | ........ | 1 | 1 |
| Total | 611 | 61 | 69 | ........ | 741 | 709 |

*Commerce of Muskingum River, etc.*—Continued.

LOCK NO. 10.

| Month. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| February | 26 | ........ | ........ | ........ | 26 | 26 |
| March | 37 | ........ | 2 | ........ | 39 | 39 |
| April | 60 | ........ | 2 | ........ | 62 | 61 |
| May | 70 | 5 | 7 | ........ | 82 | 78 |
| June | 78 | 9 | ........ | ........ | 87 | 86 |
| July | 76 | 4 | ........ | ........ | 80 | 80 |
| August | 66 | 3 | 11 | ........ | 80 | 80 |
| September | 68 | 12 | 3 | ........ | 83 | 82 |
| October | 60 | 8 | 5 | ........ | 73 | 73 |
| November | 47 | 4 | 3 | ........ | 54 | 54 |
| December | 2 | ........ | ........ | ........ | 2 | 2 |
| Total | 590 | 45 | 33 | ........ | 668 | 661 |

SUMMARY.

| Lock No. | Steamboats. | Barges. | Miscellaneous. | Rafts. | Total. | Number of lockages. |
|---|---|---|---|---|---|---|
| 1 | 580 | 42 | 57 | 63 | 742 | 671 |
| 2 | 580 | 57 | 83 | ........ | 720 | 708 |
| 3 | 578 | 62 | 68 | ........ | 708 | 693 |
| 4 | 575 | 66 | 80 | 3 | 724 | 695 |
| 5 | 131 | 47 | 43 | ........ | 221 | 206 |
| 6 | 140 | 56 | 43 | ........ | 239 | 215 |
| 7 | 133 | 59 | 42 | ........ | 234 | 215 |
| 8 | 582 | 49 | 52 | ........ | 683 | 664 |
| 9 | 611 | 61 | 69 | ........ | 741 | 709 |
| 10 | 590 | 45 | 33 | ........ | 668 | 661 |
| Total | 4,500 | 544 | 570 | 66 | 5,680 | 5,437 |

*Statement of commerce passing the locks on the Muskingum River, Ohio, during the Calendar year ending December 31, 1903.*

| Articles. | Lock No.— | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Beer | ........ | 51 | 123 | 19 | 16 | 17 | 16 | 31 | 39 | 37 |
| Brick | 180 | 534 | 459 | 375 | 27 | 12 | 21 | 980 | 1,081 | 1,085 |
| Cattle | 390 | 433 | 399 | 346 | 224 | 188 | 106 | 55 | 39 | 32 |
| Coal | 1,673 | 853 | 1,026 | 675 | 478 | 412 | 412 | 416 | 529 | 356 |
| Cement | 8 | 76 | 68 | 42 | 22 | 22 | 22 | 27 | 77 | 90 |
| Corn | 672 | 840 | 911 | 670 | 285 | 118 | 61 | 141 | 133 | 84 |
| Eggs | 541 | 615 | 579 | 516 | 315 | 285 | 215 | 73 | 54 | 39 |
| Flour | 615 | 1,187 | 1,157 | 514 | 87 | 71 | 64 | 135 | 131 | 129 |
| Hay | 601 | 1,204 | 1,162 | 1,014 | 392 | 305 | 200 | 420 | 487 | 509 |
| Hides | 8 | 9 | 9 | 13 | 5 | 4 | 10 | 20 | 18 | 20 |
| Hogs | 366 | 480 | 443 | 460 | 226 | 148 | 119 | 70 | 41 | 34 |
| Horses | 255 | 304 | 316 | 295 | 185 | 159 | 140 | 215 | 184 | 190 |
| Iron, manufactured | 877 | 1,236 | 1,192 | 1,023 | 813 | 812 | 622 | 510 | 491 | 462 |
| Leather | ........ | ........ | ........ | ........ | ........ | ........ | 1 | 16 | 17 | 12 |
| Lime | 4 | 35 | 71 | 29 | 2 | 3 | 5 | 52 | 78 | 85 |
| Lumber | 2,410 | 465 | 335 | 431 | 321 | 338 | 386 | 1,233 | 1,281 | 1,379 |
| Merchandise, miscellaneous | 15,104 | 16,758 | 16,110 | 13,433 | 7,111 | 6,521 | 5,835 | 15,299 | 17,716 | 20,007 |
| Oil | 120 | 158 | 159 | 136 | 141 | 121 | 80 | 66 | 66 | 77 |
| Poultry | 90 | 131 | 129 | 88 | 64 | 47 | 39 | 29 | 34 | 42 |
| Produce | 54 | 120 | 91 | 34 | 3 | 1 | 1 | 7 | 11 | 14 |
| Salt | 220 | 248 | 246 | 188 | 151 | 116 | 118 | 110 | 196 | 208 |
| Sand, stone, etc. | 350 | 1,387 | 1,357 | 627 | 228 | 640 | 1,205 | 592 | 1,117 | 360 |
| Sheep | 107 | 121 | 107 | 97 | 61 | 14 | 2 | 10 | 7 | 4 |
| Staves | 285 | 285 | 285 | 275 | 175 | 45 | ........ | ........ | 3 | 3 |
| Stoneware | 351 | 358 | 354 | 396 | 390 | 386 | 403 | 475 | 486 | 481 |
| Straw | 202 | 493 | 467 | 316 | 173 | 107 | 138 | 464 | 638 | 590 |
| Sugar | 1 | 25 | 25 | 16 | 8 | 2 | 1 | 20 | 22 | 30 |
| Timber | 566 | 108 | 108 | 859 | 10 | 10 | 10 | 12 | 82 | 35 |
| Wheat | 153 | 228 | 122 | 186 | 125 | 132 | 130 | 75 | 85 | 96 |
| Total | 26,203 | 25,742 | 27,480 | 22,078 | 12,056 | 11,036 | 10,362 | 21,553 | 25,143 | 26,490 |
| Passengers | 31,687 | [illegible] | [illegible] | [illegible] | 3,850 | 3,831 | 3,962 | 18,011 | 29,064 | 52,506 |

*List of steamboats (stern-wheel) plying on the Muskingum River between Zanesville and Marietta, Ohio.*

| Name of steamer. | Length. | Breadth. | Depth. | Draft. | Tonnage. |
|---|---|---|---|---|---|
| | *Feet.* | *Feet.* | *Feet.* | *Inches.* | |
| Lorena | 141 | 32 | 5 | 24 | 287 |
| Sonoma | 125 | 20 | 3½ | 23 | 116 |
| Valley Gem | 125 | 26½ | 4 | 24 | 156 |
| Vega | 104 | 17½ | 4 | 26 | 90 |
| Del Norte | 35½ | 8½ | 4½ | 40 | 5 |
| Excel | 110 | 18 | 3 | 24 | 100 |
| Zanetta[a] | 150 | 35 | 6 | 23 | 165 |
| Helen White[a] | 170 | 32 | 5 | 24 | 300 |
| T. N. Barnsdell[a] | 130 | 22 | 4 | 24 | 150 |
| Mary Stewart[a] | 100 | 19 | 3 | 20 | 90 |
| Mary H.[a] | 120 | 22 | 3 | 18 | 100 |
| Jewel[a] | 110 | 22 | 4 | 24 | 120 |
| D. T. Watson[a] | 100 | 20 | 4 | 24 | 100 |
| S. B. Goucher[a] | 120 | 24 | 4½ | 42 | 100 |
| Miles, H.[a] | 110 | 17 | 3½ | 18 | 90 |
| Harriett[a] | 180 | 36 | 5 | 36 | 250 |
| Geneive[a] | 60 | 20 | 4 | 24 | 40 |
| Nellie Walton[a] | 125 | 30 | 5 | 36 | 200 |
| Scout[a] | 110 | 20 | 4 | 24 | 150 |
| Pioneer City[a] | 100 | 35 | 4 | 24 | 100 |
| Winnifrede[a] | 125 | 30 | 5 | 30 | 200 |
| Rival[a] | 150 | 28 | 4½ | 36 | 175 |
| Merimaid[a] | 90 | 18 | 2½ | 24 | 60 |

[a] Only occasional trips.

*List of steamboats plying on the Muskingum River between Zanesville and Dresden, Ohio.*

| Name of steamer. | Length. | Breadth. | Depth. | Draft. | Tonnage. |
|---|---|---|---|---|---|
| | *Feet.* | *Feet.* | *Feet.* | *Inches.* | |
| Gold[a] | 90 | 16 | 2 | 12 | 40 |
| Outing[b] | 47 | 9 | 4 | 30 | 6 |
| Kill Kare[b] | 35 | 6 | 3 | 30 | 8 |
| Gadabout[b] | 21 | 4½ | 2½ | 22 | 2 |
| Muskingum[b] | 18 | 4 | 2 | 12 | 1 |
| England[b] | 16 | 4 | 2 | 12 | 1 |
| Janette[b] | 16 | 4 | 2 | 12 | 1 |

[a] Packet from Zanesville to Dresden, Ohio.
[b] Pleasure boats.

## G G 3.

## IMPROVEMENT OF GUYANDOT RIVER, WEST VIRGINIA.

For description see Annual Report of the Chief of Engineers for 1875, pages 747-755; 1895, pages 2517-2520; 1896, pages 2324, 2325.

Nothing has been done toward its improvement since 1899, when the removal of channel obstructions was, to a certain extent, completed. Owing to the construction of a railroad into that region very little been done of late years, the principal commerce tonnage is estimated at 150.000 tons for the past

APPROPRIATIONS:

| | |
|---|---|
| June 18, 1878 | $2,000.00 |
| March 3, 1879 | 1,000.00 |
| June 14, 1880 | 2,000.00 |
| March 3, 1881 | 3,500.00 |
| August 2, 1882 | 2,000.00 |
| July 5, 1884 | 2,000.00 |
| August 11, 1888 | 2,000.00 |
| September 19, 1890 | 2,000.00 |
| July 13, 1892 | $2,000.00 |
| August 18, 1894 | 2,000.00 |
| June 3, 1896 | 1,000.00 |
| March 3, 1899 | 1,000.00 |
| Received from other sources in previous years | 189.90 |
| Total | 22,689.90 |

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## G G 4.

## IMPROVEMENT OF BIG SANDY RIVER, WEST VIRGINIA AND KENTUCKY.

A statement of the original condition, projects, etc., will be found in the summary.

The United States has built one lock (and movable dam) on this river, which is completed and in operation, and is located at Louisa, Ky. The present project provides for 21 more, extending slack water from the mouth of the Big Sandy up the forks to Pikeville on the Levisa, and the mouth of Pond Creek on Tug Fork.

Of the locks provided for in the project, those in the Big Sandy itself are well advanced toward completion, and authority for the construction of one on each of the forks above Louisa has been given and their locations have been decided upon at Saltpeter branch on Tug, and at Chapman station on Levisa, and the land necessary for sites has been acquired.

Under the allotment for preliminary work and subsequent appropriations, the following work has been accomplished:

*At Lock and Dam No. 1, Catlettsburg, Ky.*—Good progress was made on this work, the lock being completed.

Work on the dam (which includes an abutment and protection) has been well advanced, the abutment and pass masonry being completed and part of the weir put in.

The items of work done between July 1, 1903, and June 30, 1904, by Folz & Jonte, contractors, on the lock are as below:

| Classification. | | Quantities. | Price. | Amount. |
|---|---|---|---|---|
| Timber in permanent work | M feet, B. M. | 13,350.0 | $39.00 | $520.65 |
| Paving | square yards | 268.0 | 2.00 | 536.00 |
| Riprap | cubic yards | 50.0 | 2.00 | 100.00 |
| Concrete | do | 78.2 | 4.50 | 351.90 |
| Earth excavation | do | 523.0 | .60 | 313.80 |
| Deposit | do | 472.0 | .20 | 94.40 |
| Embankment | do | 1,499.0 | .25 | 374.75 |
| Structural steel | pounds | 216,742.5 | .05 | 10,837.13 |
| Cast iron | do | 6,479.0 | | 323.95 |
| Total | | | | 13,452.58 |

The items of work done during the fiscal year by Sheridan-Kirk Contract Company, contractors, on the dam are as below:

| Classification. | Quantities. | Price. | Amount. |
|---|---|---|---|
| Cofferdam timber.....M feet B. M.. | 246,876 | $40.00 | $9,875.04 |
| Cofferdam filling.....cubic yards.. | 4,870 | .70 | 3,409.00 |
| Riprap.....do.... | 566 | 2.00 | 1,132.00 |
| Earth excavation.....do.... | 9,485 | .42 | 3,983.70 |
| Rock excavation.....do.... | 86 | 2.00 | 172.00 |
| Bolt holes in rock or masonry.....linear feet.. | 981 | .40 | 392.40 |
| Concrete.....cubic yards.. | 3,185 | 5.00 | 15,925.00 |
| Timber in permanent work.....M feet B. M.. | 27,863 | 60.00 | 1,671.78 |
| Ironwork.....pounds.. | 75,418 | .065 | 4,901.85 |
| Embankment.....cubic yards.. | 1,640 | .50 | 820.00 |
| Puddling.....do.... | 475 | 3.00 | 1,425.00 |
| Square paving.....square yards.. | 620 | 3.00 | 1,860.00 |
| Total..... | ..... | ..... | 45,567.77 |

Under contract dated May 25, 1903, the Atlas Portland Cement Company delivered 1,500 barrels Portland cement.

*At Lock No. 2, Kavanaugh, Ky.*—The lock has been completed and the dam is under construction. The following work was done by the Evansville Contract Company during the fiscal year:

| Classification. | Quantities. | Price. | Amount. |
|---|---|---|---|
| Piling (round).....linear feet.. | 314.00 | $0.50 | $157.00 |
| Cofferdam timber.....M feet B. M.. | 36,187.00 | 60.00 | 2,171.22 |
| Timber in permanent work.....do.... | 37,128.00 | 75.00 | 2,784.60 |
| Stone masonry.....cubic yards.. | 2.38 | 50.00 | 119.00 |
| Paving.....square yards.. | 248.62 | 2.80 | 696.14 |
| Riprap.....cubic yards.. | 632.60 | 3.00 | 1,897.80 |
| Concrete.....do.... | 2,354.00 | 4.00 | 9,416.00 |
| Earth excavation.....do.... | 22.00 | .50 | 11.00 |
| Loose rock.....do.... | 17.00 | 1.00 | 17.00 |
| Embankment.....do.... | 6,952.00 | .25 | 1,738.00 |
| Puddling.....do.... | 646.00 | 3.00 | 1,938.00 |
| Structural steel.....pounds.. | 186,310.00 | .35 | 6,520.85 |
| Cast iron.....do.... | 21,076.00 | .35 | 737.66 |
| Total..... | ..... | ..... | 23,204.27 |

A contract for the construction of the dam was entered into February 26, 1904, and the following work had been done up to close of fiscal year by E. Brown Baker, contractor:

| Classification. | Quantities. | Price. | Amount. |
|---|---|---|---|
| Earth excavation.....cubic yards.. | 4,840 | $0.40 | $1,936.00 |
| Rock excavation.....do.... | 1,200 | 3.00 | 3,600.00 |
| Embankment.....do.... | 2,400 | .40 | 960.00 |
| Total..... | ..... | ..... | 6,496.00 |

*Regulating works below Dam No. 1.*—In the final report on the survey (November 26, 1900) regulating works at the mouth of the river were recommended. As it is expected that the dam at the mouth (No. 1) will be put in operation during the present year, the works mentioned will be needed. Their estimated cost is $40,000. Their purpose is to assist in keeping a channel open from the lock to the

Ohio River, a distance of about one-third of a mile, so that boats may go into the Ohio at very low stage of water. These dikes are to be placed in prolongation of the lock walls so as to confine the water passing through the lock to a prescribed space and prevent its spreading out into the river. It is believed that the water thus confined, with the accelerated velocity which can be given it from the pool above dam, will be able to force the sand out of the chute into the Ohio, where the natural current of that stream will carry it away. Once clean, the chute will not refill without a rise of sufficient volume to require the lowering of the dam. The walls will be quite low, so as not to interfere with boats when there is sufficient water below the dam for navigation. The dike in prolongation of land wall will prevent undermining of the bank, acting as a retaining and guide wall.

*Improvement of Levisa and Tug forks.*—The chief object of the improvement of the Big Sandy and Levisa and Tug forks is to furnish means of transportation for the extensive coal veins lying tributary thereto. The construction of the locks and dams is well advanced on the main river, their completion being only a matter of a few months, but no adequate results can be counted upon from these works alone, as the coal lies largely on the forks above, and it will be necessary to carry the improvement well up into that region before extensive coal developments can take place. It is believed that the construction of four or five dams in each fork will start this development, and that each succeeding dam will add immensely to the output. Capital is already very active in the assembling of small tracts of land into bodies of sufficient acreage to justify operation, and a railroad is being pushed up the Levisa to a point beyond navigation, with the sole view of transporting the coal and coke of the Pike and Floyd County regions, as well as those passed through on the way thereto. Equal activity is evident on Tug which will, within a few months, have a railroad along its banks its entire length. The chief business of both these transportation lines will be the carrying of coal and coke. It is believed that upon the advent of slack water much greater development will take place than can be possible with rail facilities alone, and that a water outlet to market will be readily sought by most of the operators for a greatly increased output. At all events the construction of the lower four or five dams in each fork should be the means of determining whether a continuation of the improvement higher up would be justified by the quantity of business developed. These locks and dams are estimated to cost, on an average, $250,000 each, if built under the continuing contract system. The construction of one lock on each fork was authorized by the river and harbor act of June 13, 1902, and it is expected that they will be placed under contract shortly, the delay in making contracts having been caused by the necessity for acquiring some of the titles to the sites in the courts, owing to the exorbitant prices demanded by the owners. No provision has been made for the dams for these locks nor for the other locks and dams above. The estimated cost of these two dams is about $100,000 each.

*Levisa and Tug forks.*—A statement of the original condition of Levisa and Tug forks will be found in the Annual Report of the Chief of Engineers for 1901, pages 493, 494.

The following work was done on Levisa Fork during the past fiscal year: Removed 110 trees, 87 snags, 14 stumps, 20 yards solid rock, and 69 yards loose rock. Owing to extreme low water, work was stopped because the cost of moving boats was excessive.

On Tug Fork the following was done: Removed 90 trees, 353 snags, 19 stumps, 8 yards solid rock, and 9 yards loose rock.

This work resulted in keeping channel in navigable condition between Louisa and Pikeville on Levisa, and Williamson on Tug.

The amount usually recommended, $1,500 for each fork, will be sufficient for ordinary maintenance during the next fiscal year.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $420,748.47 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $134,369.01 | |
| For maintenance of improvement | 1,014.15 | |
| | | 135,383.16 |
| July 1, 1904, balance unexpended | | 285,365.31 |
| July 1, 1904, outstanding liabilities | | 2,960.14 |
| July 1, 1904, balance available | | 282,405.17 |
| July 1, 1904, amount covered by uncompleted contracts | | 139,095.11 |
| Amount (estimated) required for completion of existing project | | 4,065,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $365,000.00 | |
| For maintenance of improvement | 3,000.00 | |
| | | [a] 368,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| July 18, 1878 | $12,000.00 | March 3, 1899 | $52,500.00 |
| March 3, 1879 | 12,000.00 | June 6, 1900 | 280,000.00 |
| June 14, 1880 | 55,000.00 | June 6, 1900 (allotted) | 2,000.00 |
| March 3, 1881 | 50,000.00 | March 3, 1901 | 140,000.00 |
| August 2, 1882 | 25,000.00 | June 13, 1902 | 178,000.00 |
| July 5, 1884 | 50,000.00 | March 3, 1903 | 50,000.00 |
| August 5, 1886 | 30,000.00 | Amount received from other sources in previous years | 1,704.88 |
| August 11, 1888 | 31,500.00 | | |
| September 19, 1890 | 36,000.00 | | |
| July 13, 1892 | 55,000.00 | | |
| August 18, 1894 | 45,000.00 | Total | 1,138,704.88 |
| June 3, 1896 | 33,000.00 | | |

ABSTRACT OF CONTRACTS IN FORCE ON BIG SANDY RIVER DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for constructing Lock No. 1, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: Folz & Jonte.

Date of approval: November 3, 1900.

Date of beginning: On or before November 6, 1900.

Date of expiration: August 7, 1902. Extended to February 3, 1903, by supplementary contract dated June 14, 1902. Further extended to September 1, 1903, by supplementary contract dated January 29, 1903.

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[a] Of this amount $125,000 is for continuing contract work authorized by the river and harbor act approved June 13, 1902.

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Piling, round ............linear foot.. | $0.65 | Loose rock ............cubic yard.. | $1.00 |
| Cofferdam timber ........M feet B. M.. | [illegible] | Solid rock ............do.... | 1.00 |
| Timber in permanent work ......do.... | [illegible] | Deposit ............do.... | .20 |
| Stone masonry ............cubic yard.. | [illegible] | Embankment ............do.... | .25 |
| Paving ............square yard.. | 2.4[illegible] | Puddling ............do.... | 3.00 |
| Riprap ............cubic yard.. | 2.0[illegible] | Cofferdam filling ............do.... | 1.00 |
| Concrete ............do.... | 4.5[illegible] | Structural steel ............pound.. | .05 |
| Earth excavation ............do.... | .4[illegible] | Cast iron ............do.... | .05 |

Completed.

*Contract for constructing Lock No. 2, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: The Evansville Contract Company.
Date of approval: December 17, 1900.
Date of beginning: January 18, 1901.
Date of expiration: September 19, 1902. Extended to December 31, 1902, by supplementary contract dated August 16, 1902. By indorsement of the Office of the Chief of Engineers, dated January 13, 1903 (E. D., 37192), the time limit was waived.

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Piling, round ............linear foot.. | $0.50 | Loose rock ............cubic yard.. | $0.25 |
| Cofferdam timber ........M feet B. M.. | 60.00 | Solid rock ............do.... | 1.00 |
| Timber in permanent work ......do.... | 75.00 | Deposit ............do.... | .20 |
| Stone masonry ............cubic yard.. | 50.00 | Embankment ............do.... | .25 |
| Paving ............square yard.. | 2.50 | Puddling ............do.... | 3.00 |
| Riprap ............cubic yard.. | 3.00 | Cofferdam filling ............do.... | 1.00 |
| Concrete ............do.... | 4.00 | Structural steel ............pound.. | .0[illegible] |
| Earth excavation ............do.... | .50 | Cast iron ............do.... | .0[illegible] |

Completed.

*Contract for furnishing Portland cement (Lehigh brand) for Locks Nos. 1 and 2, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: Lehigh Portland Cement Company.
Date of approval: March 28, 1901.
Date of beginning: First consignment to be ordered for delivery on or about April 30, 1901.
Date of expiration: Contingent upon progress of the work; to expire by limitation on June 1, 1902.

[NOTE.—This contract has been practically completed, all cement having been delivered and all payments made with the exception of $460.06 retained percentage, which is being held in view of a possible claim against the United States for damages by the Evansville Contract Company, account of delay in delivery of cement on time.]

| Item. | Contract price. |
|---|---|
| LEHIGH PORTLAND CEMENT. | |
| Delivered at Catlettsburg, Ky. (4,000 barrels minimum, 10,000 barrels maximum)— | |
| In standard paper bags............per barrel.. | $1.45 |
| In barrels............do.... | 1.63 |
| Delivered at Wrights, Ky. (6,000 barrels minimum, 12,000 barrels maximum)— | |
| In standard paper bags............do.... | 1.56 |
| In barrels............do.... | 1.75 |

*Contract for constructing Dam No. 1, with abutment and protection, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: Sheridan-Kirk Contract Company.

Date of approval: April 18, 1903.

Date of beginning and date of expiration: Concrete must be completed within one hundred fair working days, Sundays excepted, after August 1, 1903; remaining work within sixty fair working days after the expiration of the one hundred days above specified.

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Piling, round ............... linear foot.. | $0.50 | Timber in permanent work, M feet B. M. ........................ | $60.00 |
| Cofferdam timber ......... M feet B. M.. | 40.00 | Ironwork ..................... pound.. | .06½ |
| Cofferdam filling ........... cubic yard.. | .70 | Embankment ............ cubic yard.. | .50 |
| Riprap ........................ do.... | 2.00 | Puddling ........................ do.... | 3.00 |
| Earth excavation ................ do.... | .42 | Square paving ........... square yard.. | 3.00 |
| Rock excavation ................ do.... | 2.00 | Rough paving ................... do.... | 2.50 |
| Bolt holes in rock or masonry, linear foot ................................ | .40 | Removal of old cofferdam of lock, whole work ......................... | 500.00 |
| Concrete ................... cubic yard.. | 5.00 | | |

*Contract for furnishing about 5,000 barrels Atlas Portland cement at Catlettsburg, Ky., for use at Dam No. 1, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: Atlas Portland Cement Company.

Date of approval: May 25, 1903.

Date of beginning: When ordered (par. 37).

Date of expiration: Depending upon progress of construction work (see par. 37).

| Item. | Contract price. |
|---|---|
| About 5,000 barrels Atlas Portland cement, delivered at Catlettsburg, Ky .......... barrel.. | [a] $2.46 |

[a] Rebate of 10 cents allowed for each empty bag returned to point of delivery.

*Contract for constructing Dam No. 2, with bank protection, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: E. Brown Baker.

Date of approval: March 17, 1904.

Date of beginning and date of expiration: Concrete must be completed within one hundred fair working days, Sundays excepted, after August 1, 1904; remaining work within sixty fair working days after the expiration of the one hundred fair working days above specified.

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Piling, round ............. linear foot.. | $0.75 | Concrete ................. cubic yard.. | $6.00 |
| Cofferdams ............... whole work.. | 13,000.00 | Timber in permanent work, M feet B. M. ........................ | 70.00 |
| Riprap, furnished and placed, cubic yard ................................ | 1.00 | Iron work ..................... pound.. | .06 |
| Riprap, placed ........... cubic yard.. | 1.00 | Embankment ........... cubic yard.. | .40 |
| Earth excavation ............... do.... | .40 | Paving .................. square yard.. | 2.50 |
| Rock excavation ............... do.... | 3.00 | Removal of old cofferdam of lock, whole work ......................... | 500.00 |
| Bolt holes in rock or masonry, linear foot ................................ | .50 | | |

*Contract for furnishing Portland cement (Old Dominion brand) for Dam No. 2, Big Sandy River, West Virginia and Kentucky.*

Name of contractor: Virginia Portland Cement Company.
Date of approval: May 17, 1904.
Date of beginning: June 3, 1904, if so ordered.
Date of expiration: Season of 1904 or 1905, depending upon progress of work.

| Item. | Contract price. |
|---|---|
| 2,500 barrels American Portland cement, delivered f. o. b. cars Kavanaugh, Ky., in cotton bags ........ per barrel.. | $1.75 |
| Rebate allowed on empty bags returned ........ per bag.. | .10 |

## COMMERCIAL STATISTICS.

*Big Sandy River, West Virginia and Kentucky, including Tug and Levisa forks, for calendar year ending December 31, 1903, and prior years.*

| Articles. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Timber | 200,000 | 210,000 | 200,000 | 260,000 | 250,000 | 134,685 |
| Hides | | 75 | | 34 | 15 | 22 |
| Leather | | | | 1 | 1 | 3 |
| Lumber | 300 | | | 15,000 | 98 | 379 |
| Produce | 12,000 | 18,900 | 15,000 | 9,000 | 6,000 | 52 |
| Live stock | 10,000 | 1,145 | 2,000 | 225 | 726 | 404 |
| Spokes | | | | 19 | 55 | 1,763 |
| Staves | 2,000 | 452 | 1,000 | 3,450 | 1,720 | 1,604 |
| Tan bark | 500 | | | 550 | 35 | |
| Ties | 90,000 | 45,000 | 50,000 | 44,000 | 44,057 | 123,200 |
| Grain | 600 | 609 | 500 | 154 | 195 | 1,674 |
| Wool | | | | 2 | 2 | 2 |
| Miscellaneous | 100,000 | 66,250 | 29,000 | 19,000 | 47,614 | 26,017 |
| Passengers | 2,000 | 2,575 | 2,500 | 386 | 412 | 1,086 |
| Total | 417,400 | 345,775 | 300,000 | 349,882 | 350,985 | 290,491 |

No new lines of transportation have been established.

*List of boats plying Big Sandy River, West Virginia and Kentucky, and Tug and Levisa forks of same.*

| Name of boat. | Character. | Length. | Breadth. | Depth. | Tonnage. |
|---|---|---|---|---|---|
| Lorina | Side-wheel | 90.0 | 19.0 | 2.0 | |
| Alma | do | 116.0 | 19.2 | 3.2 | 45.00 |
| Louisa | Stern-wheel | 109.5 | 18.4 | 3.0 | 56.00 |
| Cando | do | 117.5 | 20.0 | 3.0 | 74.00 |
| Catherine Davis | do | 155.0 | 26.0 | 4.0 | 210.00 |
| Cricket | do | 132.0 | 18.3 | 2.9 | 51.00 |
| Gayandotte | Side-wheel | 104.0 | 16.0 | 2.8 | 42.88 |
| Sea Lion (tow) | Stern-wheel | 125.0 | 22.0 | 3.5 | 127.00 |
| M. B. Goble | do | 90.0 | 18.0 | 3.5 | 116.00 |
| Vincennes | do | 98.5 | 20.0 | 3.3 | 81.49 |
| J. M. Grubbs | do | 90.0 | 20.0 | 3.2 | 47.00 |
| Miles H | do | 96.0 | 18.0 | 3.0 | 46.00 |
| Eclipse | do | 100.0 | 17.0 | 3.5 | 57.00 |
| Big Sandy | Side-wheel | 110.0 | 14.0 | 1.8 | 24.12 |
| Katie Mc | Stern-wheel | 100.0 | 18.0 | 2.5 | 41.00 |

*List of vessels, rafts, etc., passing lock and dam on Big Sandy River during the calendar year ending December 31, 1903.*

| Craft. | Up. | Down. | Total. |
|---|---|---|---|
| Steamboats | 161 | 163 | 324 |
| Barges and flats | 47 | 39 | 86 |
| Rafts | | 2,141 | 2,141 |
| Ties | | 87,964 | 87,964 |
| Miscellaneous | 10 | 5 | 15 |

## G G 5.

### OPERATING AND CARE OF LOCK AND DAM (NO. 3) ON BIG SANDY RIVER, WEST VIRGINIA AND KENTUCKY.

Lock and Dam No. 3, the only one on this river at present, is located at Louisa, Ky., and was completed and open to navigation January 1, 1897.

The dam is movable and of the needle type. A full description is given in the Annual Report of the Chief of Engineers for 1897, pages 2534 et seq.

The dam was lowered for the winter on November 29, 1903, and the first spring raising occurred May 24, 1904.

During the fiscal year the paving which had been commenced below lock was still further extended, but not completed; the fences along right of way of Norfolk and Western Railway were built, and general repairs were made to dam and property.

The total amount expended during the year ending June 30, 1904, was $3,255.68.

Commercial statistics are included in the report for improving Big Sandy River.

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ALLOTMENTS.

| | | | |
|---|---|---|---|
| July 23, 1897 | $2,840.00 | July 10, 1901 | $3,658.12 |
| July 23, 1898 | 3,250.95 | July 17, 1902 | 5,075.88 |
| July 19, 1899 | 3,524.28 | July 18, 1903 | 2,677.98 |
| July 18, 1900 | 3,177.09 | | |

---

*Maneuvers of Lock and Dam No. 3, in Big Sandy River, West Virginia and Kentucky, at Louisa, Ky., for the fiscal year ending June 30, 1904.*

Raised May 16, 1903.
Lowered November 29, 1903.
Raised May 24, 1904.
Lowered May 31, 1904.
Raised June 28, 1904.
Lowered June 29, 1904.

*Summary of expenditures for operating and care of lock and dam on Big Sandy River, West Virginia and Kentucky, for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Office expenses, superintendence, and contingencies | $460.00 |
| Labor | 2,488.43 |
| Expenses | 94.64 |
| Repairs | 212.61 |
| Total | 3,255.68 |

## G G 6.

## IMPROVEMENT OF KENTUCKY RIVER, KENTUCKY.

A statement of the condition of the river in 1879, when it was turned over to the United States by the Commonwealth of Kentucky, will be found in the Annual Report of the Chief of Engineers for 1898, pages 2012 et seq.

There are 9 locks and dams of the projected series of 14 completed and in operation, and Locks and Dams Nos. 10 and 11 under construction. Lock No. 10 is located between Ford and Boonsboro, Ky., 176¼ miles from the mouth, and Lock No. 11 is located about a mile and a half from College Hill, Ky., 200 miles from the mouth of the river.

The locations and other information pertaining to the completed work of navigation will be found in the Annual Report of the Chief of Engineers for 1899, page 2523.

The work accomplished during the fiscal year is given below:

*Lock and Dam No. 9.*—The construction of the lock and fixed dam continued under the contract with the Sheridan-Kirk Contract Company. The guide cribs, filling behind land wall, and lock gates were finished last season. The cofferdam for the dam was begun July 12, and the dam completed November 16. The first lockage was made December 3, and the work closed for the season about December 24. The paving back of the land wall and on top of the guard cribs and some minor finishing-up work was done this season, and the contract completed at the end of the fiscal year.

*Lock and Dam No. 10.*—The construction of this lock and dam, including lockhouses and outbuildings, but not including the cement, was let in one contract to the Mason and Hoge Company, of Frankfort, Ky. During the year the concrete in the lock, approach walls, piers, and 88 feet of the dam was completed, all ironwork delivered, the upper gates erected, and a beginning made in the erection of the lower gates. The filling valves and machinery were placed, and other miscellaneous ironwork. The excavation in the lock cofferdam was completed, and all except about 2,000 yards of the fill behind the land wall placed. A small amount of grading and riprapping the bank was done. A beginning was made removing the lock cofferdam.

The necessary cement was supplied by the United States under a contract with the Virginia Portland Cement Company.

A survey to determine the extent of the land to be overflowed by the pool was made.

*Lock and Dam No. 11.*—Under contract with Todd & Sons, of Richmond, Ky., the lockhouses and outhouses were completed in December, 1903. On September 28, 1903, a contract was entered into with H. E. Talbott & Co., of Dayton, Ohio, for the material, except the cement, and the labor necessary to construct the lock and dam complete. This contract was approved October 19. Owing to the lateness of the season nothing was accomplished under this contract during the season of 1903. This season the contractors have assembled and erected a very elaborate plant, built a mile of turnpike and two inclines to connect the work with the main road, assembled considerable material, commenced excavating for the land wall and lock cofferdam, and commenced the construction of the cofferdam.

A contract was entered into with the Virginia Portland Cement Company, under date of June 9, 1904, for furnishing Portland cement for the work.

The new plant at No. 11 is of wire cable way, in duplicate, one end being worked in a circle on wide railway. The contractors intend excavating and handling all material in all cases by these cables. This, if successful, will obviate the need for dredges and movable derricks, and must be taken as a good example of the application of the most modern methods for such work. The plant is also above all floods, and hence the winter and spring rises do not require removal or replacing, which will save much expense. It is much to be desired that this plant will be a complete success. All material for the work thus far has been hauled 6 miles by road and then up and down a steep hill by an inclined railway made by the contractors. The cement is to take the same route.

The commercial statistics are given in the report for operation and care of the locks and dams on the Kentucky River.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $650,665.29 |
| May 1, 1900, refunded by Captain Warren | .75 |
| May 14, 1904, received from transfer Engineer property | 916.75 |
| | 651,582.79 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 193,139.34 |
| July 1, 1904, balance unexpended | 458,443.45 |
| July 1, 1904, outstanding liabilities | 1,042.78 |
| July 1, 1904, balance available | 457,400.67 |
| July 1, 1904, amount covered by uncompleted contracts | 313,293.05 |
| Amount (estimated) required for completion of existing project | 1,935,000.00 |

APPROPRIATIONS.

| | |
|---|---|
| March 3, 1879 | $100,000.00 |
| June 14, 1880 | 100,000.00 |
| March 3, 1881 | 125,000.00 |
| August 3, 1882 | 225,000.00 |
| July 5, 1884 | 250,000.00 |
| August 5, 1886 | 187,500.00 |
| August 11, 1888 | 180,000.00 |
| September 19, 1890 | 180,000.00 |
| July 13, 1892 | 150,000.00 |
| August 18, 1894 | 125,000.00 |
| June 3, 1896 | 50,000.00 |
| June 3, 1896 | 83,000.00 |
| June 4, 1897 | 200,000.00 |
| July 1, 1898 | 350,000.00 |
| June 6, 1900 | 75,000.00 |
| March 3, 1901 | 150,000.00 |
| June 28, 1902 | 200,000.00 |
| March 3, 1903 | 200,000.00 |

| | |
|---|---|
| Received from Tabor & Cogar, October, 1888 | $500.00 |
| July 13, 1899, overpayment refunded | .20 |
| May 1, 1900, overpayment refunded | .75 |
| Received from O'Brien & Gulden, March 31, 1893. | 6,000.00 |
| March 6, 1903, received from sale of condemned property | 53.10 |
| May 14, 1904, received from transfer of engineer property to Big Sandy River. | 916.75 |
| Amount received from other sources in previous years. | 84.22 |
| Total | 2,938,055.02 |

## ABSTRACT OF CONTRACTS IN FORCE ON KENTUCKY RIVER, KENTUCKY, DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

### *Contract for constructing Lock and Dam No. 9, Kentucky River, Kentucky.*

Name of contractor: The Sheridan-Kirk Contract Company.
Date of approval: June 12, 1901.
Date of beginning: July 15, 1901.
Date of expiration: June 15, 1903. Extended to December 15, 1903.

[NOTE.—This contract was modified, with respect to construction of cofferdams, by supplementary contract dated April 21, 1903; approved May 11, 1903.]

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Ballast ........ cubic yard.. | $1.50 | Iron and steel ........ pound.. | $0.04½ |
| Cofferdam filling ........ do.... | .50 | Masonry ........ cubic yard.. | 50.00 |
| Cofferdam timber ........ M feet B. M.. | 35.00 | Paving, if concrete ........ square yard.. | 1.75 |
| Concrete ........ cubic yard.. | 3.90 | Paving, if stone ........ do.... | 2.75 |
| Deposit ........ do.... | .50 | Piles ........ linear foot.. | .50 |
| Driftbolts ........ pound.. | .03½ | Timber in permanent construction, M feet B. M ........ | 42.00 |
| Excavation, earth ........ cubic yard.. | .40 | Valves ........ set.. | 500.00 |
| Excavation, rock ........ do.... | 3.00 | Winches ........ do.... | 100.00 |
| Embankment ........ do.... | .35 | | |
| Fence in place ........ linear foot.. | .25 | | |
| Hauling cement: | | | |
| If delivered by rail ........ barrel.. | .07 | | |
| If delivered by water ........ do.... | .07 | | |

### *Contract for building Lock and Dam No. 10, etc., Kentucky River, Kentucky.*

Name of contractor: Mason & Hoge Company.
Date of approval: June 30, 1902.
Date of beginning: August 3, 1902.
Date of expiration: August 3, 1905.

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Cofferdam timber ........ M feet B. M.. | $35.00 | Concrete ........ cubic yard.. | $3.80 |
| Timber in permanent construction, M feet B. M ........ | 50.00 | Riprap ........ do.... | 1.50 |
| Piling ........ linear foot.. | .40 | Stone masonry ........ do.... | 50.00 |
| Cofferdam filling ........ cubic yard.. | .50 | Iron and steel ........ pound.. | .05¼ |
| Embankment ........ do.... | .35 | Driftbolts ........ do.... | .04 |
| Earth excavation ........ do.... | .40 | Fence ........ linear foot.. | .15 |
| Rock excavation ........ do.... | 2.00 | Dwellings ........ each.. | 2,500.00 |
| Deposit ........ do.... | .40 | Outbuildings ........ do.... | 150.00 |
| | | Cisterns ........ do.... | 100.00 |

### *Contract for furnishing about 15,000 barrels American Portland cement (Old Dominion brand) at Ford, Ky., for use in the construction of Lock and Dam No. 10, Kentucky River, Kentucky.*

Name of contractor: Virginia Portland Cement Company.
Date of approval: July 5, 1902.
Date of beginning: When ordered.
Date of expiration: December 31, 1903.

| Item. | Contract price. |
|---|---|
| American Portland cement, Old Dominion brand (13,500 barrels minimum, 19,500 barrels maximum), delivered at Ford, Ky.: | |
| Delivered in barrels or bags ........ barrel.. | $2.10 |
| Rebate allowed on empty bags returned ........ per bag.. | .05 |

Completed.

### *Contract for building 2 frame dwellings, 2 frame outhouses, and 2 brick cisterns at the site of Lock No. 11, Kentuckey River, Kentucky.*

Name of contractor: Todd & Sons.
Date of approval: July 11, 1903.
Date of beginning: August 13, 1903.
Date of expiration: February 13, 1904.

| Item. | Contract price. |
|---|---|
| 2 frame dwellings, 2 frame outhouses, and 2 brick cisterns | $6,100.00 |

Completed.

### *Contract for building Lock and Dam No. 11, Kentucky River, Kentucky.*

Name of contractor: H. E. Talbott & Co.
Date of approval: October 19, 1903..
Date of beginning: November 21, 1903.
Date of expiration: January 1, 1907.

| Item. | Contract price (unit rate). | Item. | Contract price (unit rate). |
|---|---|---|---|
| Cofferdam timber ........M feet B. M.. | $39.00 | Armored concrete, exclusive of steel, cubic yard | $4.95 |
| Timber in permanent construction, linear foot | 50.00 | Riprap ....................cubic yard.. | 1.70 |
| Piling ....................linear foot.. | .40 | Rough paving....................do.... | 1.70 |
| Cofferdam filling..........cubic yard.. | .45 | Stone masonry....................do.... | 50.00 |
| Embankment ....................do.... | .40 | Iron and steel..................pound.. | .07 |
| Earth excavation....................do.... | .45 | Driftbolts ....................do.... | .06 |
| Rock excavation ....................do.... | 2.50 | Fence....................linear foot.. | .80 |
| Deposit ....................do.... | .50 | Tile drain....................do.... | .50 |
| Concrete....................do.... | 4.65 | | |

### *Contract for furnishing about 15,000 barrels American Portland cement (Old Dominion brand) at Ford, Ky., and Richmond or Moberly, Ky., for use in the completion of Lock and Dam No. 10, and in the construction of Lock and Dam No. 11, Kentucky River, Kentucky.*

Name of contractor: Virginia Portland Cement Company.
Date of approval: June 28, 1904.
Dates of beginning and expiration: The cement must be delivered as required in lots of from 1 to 8 carloads each within fifteen days after receipt of order. If not completed in 1904, the contract will continue in effect during season of 1905.

| Item. | Contract price. |
|---|---|
| American Portland cement, Old Dominion brand (7,500 barrels minimum, 22,500 barrels maximum, delivered at Ford, Ky., and Richmond or Moberly, Ky.: | |
| Delivered in bags at Ford, Ky ....................barrel.. | $1.87 |
| Delivered in bags at Richmond, Ky....................do.... | 1.91 |
| Delivered in bags at Moberly, Ky ....................do.... | 1.98 |
| Rebate allowed on empty bags returned....................per bag.. | .10 |

## G G 7.

## OPERATING AND CARE OF LOCKS AND DAMS ON KENTUCKY RIVER, KENTUCKY.

Information relating to location of Locks and Dams Nos. 1 to 8 may be found in the Annual Report of the Chief of Engineers for 1899, page 2523. Reference is also made to page 2012 et seq. of Annual Report of the Chief of Engineers for 1898, in which the condition of Kentucky River is described in 1879 when ceded to the United States by the Commonwealth of Kentucky.

There are nine locks and dams open to navigation on the Kentucky River. The first lockage through Lock No. 9 was made December 3, 1903. This lock is 17.4 miles above Lock No. 8, and 157.2 miles from the Ohio River.

These locks have been in operation during the fiscal year, except as noted below:

Lock No. 1: 26 days by ice, 30 days submerged by freshet in Ohio River. Total number of days, 56.

Lock No. 2: 26 days by ice, 4 days submerged by freshet in Ohio River. Total number of days, 30.

Lock No. 3: 26 days by ice, 4 days repairs to lock gates. Total number of days, 30.
Lock No. 4: 24 days by ice. Total number of days, 24.
Lock No. 5: 23 days by ice. Total number of days, 23.
Lock No. 6: 24 days by ice. Total number of days, 24.
Lock No. 7: 23 days by ice. Total number of days, 23.
Lock No. 8: 19 days by ice. Total number of days, 19.
Lock No. 9: 30 days by ice. Total number of days, 30.

A depth of 6 feet at pool stage exists at close of year throughout the improved portion of the river except in lower entrance at Lock No. 2, where there is 5.85 feet, and on the upper miter sill at Lock No. 4, where there is scant 5.6 feet.

The highest stage of the river was 14.4 feet, being the upper gauge reading at Lock No. 4 on March 27, 1904, or 8.8 feet above pool level.

The Kentucky River is now navigable to Lock No. 10, near Ford, Ky., 176 miles from the Ohio River.

A statement of the work accomplished during the last fiscal year is as follows:

*Lock No. 1.*—A concrete saddle was constructed to raise the crest of dam 1 foot for a distance of 50 feet from the river wall of the lock; 34 cubic yards of concrete were laid; 80 cubic yards of concrete were placed in repairs to lower slope of dam; 725 cubic yards of derrick stone were placed at toe of dam and of abutment, to counteract the effect of scour; 310 cubic yards of riprap were placed to protect bank at abutment. Owing to repairs made elsewhere on the river, this work was started late in the season and was not completed; repairs were also made to coping of lock walls and to grounds and houses.

*Lock No. 2.*—Two hundred and ninety linear feet of down-river slope and apron of this dam were reconstructed of concrete, completing the work undertaken in 1903 and not then finished; 1,698 cubic yards of concrete were used to complete these repairs; 141 linear feet of upper land-approach wall extending immediately above lock wall was renewed with concrete, 358 cubic yards placed.

Mr. John Short completed the lower approach walls under an open-market agreement. These are constructed with concrete.

*Lock No. 3.*—The lower land-approach wall was reconstructed by

Mr. John Short, under an open-market agreement. This was constructed with concrete.

*Lock No. 4.*—The lower land-approach wall, rotted by age, has been removed and work of constructing isolated concrete piers with grillage is now in progress.

Minor repairs to houses and grounds have been made. Machinery and appliances pertaining to operating and care, Kentucky River, have been kept in serviceable condition and various incidental repairs have been made here by the regular force to water crafts and lock grounds.

*Lock No. 6.*—Minor repairs have been made to screens of filling culverts.

*Lock No. 8.*—Repairs to timber-crib dam have been completed; 846 cubic yards of derrick stone placed in lower step and at toe of dam; 510 cubic yards concrete placed in lower step.

*United States dredges.*—Both dredges have been actively engaged during the working season in dredging and assisting in work of reconstruction at Locks Nos. 1 and 2.

Dredge *No. 1* has operated at Leestown bar, Canoe Creek shoal, Little Benson bar, in lower entrance, Lock No. 9, assisted in reconstruction of approach walls and repairs to dams at Locks Nos. 1 and 2, and placed backing to check leakage of Dam No. 2.

| | |
|---|---|
| Total number of cubic yards excavated | 37,900 |
| Cost per cubic yard | $0.0971 |

Dredge *No. 2* removed deposits from Locks Nos. 1 to 8, inclusive, assisted in repairs to Dam No. 1; placed backing to check leakage of Dams Nos. 4, 5, and 6.

| | |
|---|---|
| Total number of cubic yards excavated | 28,207 |
| Cost per cubic yard | $0.1501 |

The expenses incurred in towing the dredges by the various towboats acting as tenders are not included in the average cost per cubic yard, nor are the wages of the crews charged while they were assisting in reconstruction work at Locks Nos. 1 and 2.

The result of the dredging operations have been to maintain a good navigable channel through all bars and shoals in the slack-water system of the Kentucky River formerly impeding navigation, and the lock pits and approaches have been kept free from deposits at low stages of river.

The U. S. towboat *Genl. O. M. Poe* has been employed during the working season of 1903 in towing Engineer Department water crafts and in assisting in reconstruction work; has been since May 30, 1904, undergoing extensive repairs at Cincinnati, Ohio.

ALLOTMENTS.

| | | | |
|---|---|---|---|
| July, 1884 | $15,000.00 | July 24, 1896 | $70,198.85 |
| July, 1885 | 27,615.00 | August 2, 1897 | 49,272.11 |
| July 31, 1886 | 33,965.00 | July 15, 1898 | 53,531.39 |
| July, 1887 | 79,862.14 | July 29, 1899 | 63,884.24 |
| July, 1888 | 82,478.50 | May 11, 1900 | 2,500.00 |
| July 28, 1889 | 72,394.80 | July 17, 1900 | 82,284.09 |
| July 17, 1890 | 28,889.07 | July 9, 1901 | 109,137.49 |
| July 16, 1891 | 36,331.38 | August 19, 1901 | 952.00 |
| November 28, 1891 | 1,112.50 | February 4 1902 | 19,000.00 |
| December 14, 1891 | 11,382.80 | July 22, 1902 | 79,634.91 |
| July 15, 1892 | 38,503.62 | July 20, 1903 | 56,971.61 |
| June 13, 1893 | 2,000.00 | Received from other sources in this and previous years | 114.65 |
| July 14, 1893 | 73,065.02 | | |
| July 16, 1894 | 46,435.28 | | |
| July 20, 1895 | 59,120.04 | Total | 1,195,636.49 |

*Summary of expenditures for operating and care of locks and dams on Kentucky River, Kentucky, for fiscal year ending June 30, 1904.*

| | |
|---|---|
| Office expenses, superintendence, and contingencies | $9,556.99 |
| Labor | 29,536.51 |
| Fuel | 4,830.00 |
| Expenses | 4,053.78 |
| Repairs | 32,606.62 |
| Total | 80,583.90 |

The new concrete dam at No. 9, with 18 feet lift, had its first experience with logs during the past winter. From this we learned that the "back lash" or "reaction" is to be dealt with in such constructions. The effect seemed to be worse with the gauge at 18 feet, when logs were held sometimes as long as thirty hours, going back to the dam with a savage blow, then diving and reappearing, perhaps to circle, then to repeat the attack. The ends of such logs were so badly hammered that the owners are not likely to wish a repetition of the experience with valuable timber, but the effect on the downstream face of the dam at such levels was marked. Horizontal cuts are made, perhaps a foot deep, certainly more than 6 inches (the water is not yet low enough to allow of exact measurement), and the greater part of the middle downstream face of the dam is marred. Also there is a torn space on the lower crest for some 30 feet. It is proposed to excavate the cut holes and put in timbers, with driftbolts, to act as cushions, for the present at any rate. Perhaps a more gentle slope, as at Nos. 1 and 2, would lessen this trouble. At any rate nothing of this character is reported from either of these two dams, both recently topped with concrete.

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## ABSTRACT OF CONTRACTS IN FORCE, OPERATING AND CARE KENTUCKY RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract (emergency) for furnishing Portland cement for repairs on Kentucky River, Kentucky.*

Name of contractor: Virginia Portland Cement Company.
Date of contract: August 31, 1903.
Date of approval: Emergency contract.
Date of beginning and date of expiration: To deliver 100 barrels within twenty days after date of contract, and carload lots every five days thereafter, until completion of contract.

| Item. | Contract price. |
|---|---|
| Portland cement, Old Dominion brand (1,500 barrels, minimum; 3,000 barrels, maximum), delivered free on board cars at Frankfort, Ky., in cotton bags ........ per barrel.. | $2.11 |
| Rebate allowed for empty bags returned ........ per bag.. | .10 |

Completed.

## COMMERCIAL STATISTICS.

*Statement of traffic passing the locks on Kentucky River during the calendar years 1900, 1901, 1902, and 1903.*

| Lock— | Passengers. | | | | Towboats. | | | | Government boats. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. |
| No. 1 | 1,007 | 695 | 391 | 567 | 160 | 217 | 149 | 139 | 36 | 13 | 26 | 8 |
| No. 2 | 705 | 588 | 317 | 473 | 162 | 209 | 131 | 150 | 32 | 36 | 42 | 33 |
| No. 3 | 371 | 244 | 251 | 239 | 134 | 194 | 148 | 131 | 40 | 81 | 118 | 90 |
| No. 4 | 380 | 262 | 306 | 318 | 172 | 210 | 172 | 160 | 48 | 66 | 173 | 171 |
| No. 5 | 262 | 199 | 203 | 215 | 65 | 78 | 53 | 66 | 66 | 50 | 51 | 60 |
| No. 6 | 209 | 183 | 186 | 228 | 40 | 32 | 28 | 50 | 57 | 55 | 56 | 44 |
| No. 7 | 196 | 181 | 203 | 294 | 25 | 41 | 34 | 49 | 61 | 41 | 46 | 35 |
| No. 8 | 13 | 76 | 78 | 171 | 6 | 22 | 15 | 22 | 2 | 31 | 82 | 24 |
| No. 9 | | | | | | | | 1 | | | | |
| Total | 3,143 | 2,428 | 1,935 | 2,505 | 764 | 1,003 | 730 | 768 | 342 | 373 | 544 | 465 |

| Lock— | Coal barges. | | | | Other barges. | | | | Small crafts. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. |
| No. 1 | 205 | 208 | 124 | 170 | 196 | 131 | 239 | 325 | 64 | 84 | 52 | 56 |
| No. 2 | 181 | 186 | 92 | 152 | 97 | 137 | 115 | 213 | 43 | 47 | 35 | 71 |
| No. 3 | 176 | 188 | 86 | 149 | 90 | 257 | 238 | 256 | 49 | 90 | 62 | 81 |
| No. 4 | 194 | 186 | 88 | 152 | 135 | 204 | 272 | 339 | 135 | 142 | 154 | 142 |
| No. 5 | 61 | 60 | 30 | 42 | 132 | 122 | 166 | 287 | 146 | 80 | 95 | 71 |
| No. 6 | 33 | 22 | 17 | 21 | 120 | 107 | 159 | 220 | 135 | 206 | 175 | 290 |
| No. 7 | 28 | 27 | 17 | 19 | 109 | 96 | 160 | 270 | 175 | 149 | 121 | 101 |
| No. 8 | 2 | 7 | 5 | 12 | 70 | 49 | 61 | 190 | 20 | 74 | 62 | 85 |
| No. 9 | | | | | | | | 2 | | | | 5 |
| Total | 880 | 884 | 459 | 717 | 949 | 1,103 | 1,410 | 2,102 | 767 | 872 | 756 | 902 |

| Lock— | Rafts. | | | | Total. | | | | Increase over 1902. |
|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. | |
| No. 1 | 335 | 537 | 213 | 656 | 2,003 | 1,885 | 1,194 | 1,921 | 727 |
| No. 2 | 342 | 508 | 208 | 644 | 1,562 | 1,711 | 940 | 1,736 | 796 |
| No. 3 | 339 | 501 | 217 | 664 | 1,199 | 1,555 | 1,120 | 1,610 | 490 |
| No. 4 | 331 | 506 | 236 | 686 | 1,395 | 1,576 | 1,401 | 1,968 | 567 |
| No. 5 | 1,266 | 1,648 | 1,084 | 1,514 | 1,998 | 2,237 | 1,682 | 2,255 | 573 |
| No. 6 | 1,289 | 1,644 | 940 | 1,536 | 1,883 | 2,249 | 1,561 | 2,389 | 828 |
| No. 7 | 1,284 | 1,588 | 1,109 | 1,312 | 1,878 | 2,123 | 1,690 | 2,110 | 420 |
| No. 8 | 93 | 1,883 | 1,501 | 1,832 | 206 | 2,142 | 1,754 | 2,336 | 582 |
| No. 9 | | | | | | | | 8 | 8 |
| Total | 5,279 | 8,815 | 5,508 | 8,874 | 12,124 | 15,478 | 11,342 | 16,333 | 4,991 |

| Lock. | Total tonnage. | | | | Increase over 1902. | Lockages. | | | | Increase over 1902. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | | 1900. | 1901. | 1902. | 1903. | |
| No. 1 | 185,121 | 183,773 | 138,370 | 204,953 | 66,583 | 1,583 | 1,221 | 714 | 1,201 | 487 |
| No. 2 | 166,068 | 176,283 | 111,190 | 181,203 | 70,013 | 1,280 | 1,304 | 719 | 1,161 | 442 |
| No. 3 | 149,588 | 191,051 | 114,862 | 176,507 | 61,645 | 1,030 | 1,200 | 867 | 1,183 | 316 |
| No. 4 | 157,664 | 161,719 | 131,045 | 189,901 | 58,856 | 1,114 | 1,173 | 1,101 | 1,429 | 328 |
| No. 5 | 168,948 | 186,461 | 137,509 | 188,071 | 50,562 | 1,325 | 1,303 | 1,081 | 1,398 | 317 |
| No. 6 | 154,609 | 170,499 | 124,870 | 178,264 | 53,394 | 883 | 1,068 | 843 | 1,215 | 372 |
| No. 7 | 152,592 | 168,730 | 131,413 | 162,880 | 31,467 | 859 | 966 | 833 | 1,029 | 196 |
| No. 8 | 22,039 | 166,109 | 132,038 | 178,212 | 46,174 | 135 | 879 | 692 | 924 | 232 |
| No. 9 | | | | 342 | 342 | | | | 3 | 3 |
| Total | 1,154,629 | 1,404,645 | 1,021,297 | 1,460,333 | 439,036 | 8,209 | 9,114 | 6,850 | 9,543 | 2,693 |

*Statement of commerce, in tons, passing the locks on Kentucky River, Kentucky, during the calendar years 1900, 1901, 1902, and 1903.*

| Articles. | Lock No. 1. | | | | Lock No. 2. | | | |
|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. |
| Coal | 53,147 | 55,742 | 34,554 | 47,933 | 47,055 | 51,656 | 27,525 | 43,450 |
| Grain | 8,391 | 6,122 | 2,787 | 3,985 | 8,170 | 6,493 | 2,323 | 3,457 |
| Salt | 768 | 1,074 | 540 | 504 | 566 | 824 | 415 | 341 |
| Oil | 493 | 543 | 274 | 358 | 280 | 378 | 199 | 204 |
| Whisky | 1,239 | 1,128 | 1,128 | 1,357 | 1,343 | 1,295 | 1,200 | 1,349 |
| Flour | 1,286 | 1,264 | 1,380 | 2,264 | 725 | 542 | 994 | 1,584 |
| Sugar | 277 | 287 | 210 | 315 | 188 | 122 | 157 | 151 |
| Molasses | 138 | 123 | 80 | 55 | 91 | 62 | 69 | 35 |
| Cement | 499 | 355 | 521 | 292 | 353 | 172 | 333 | 193 |
| Tobacco | 4,385 | 4,576 | 3,305 | 2,902 | 2,924 | 3,267 | 1,923 | 1,591 |
| Hay | 932 | 221 | 867 | 1,014 | 537 | 122 | 608 | 212 |
| Live stock | 931 | 952 | 650 | 1,139 | 450 | 490 | 357 | 687 |
| Lumber and timber | 24,697 | 39,841 | 29,212 | 52,443 | 25,174 | 37,614 | 17,046 | 52,906 |
| Shingles | 934 | 201 | 111 | 184 | 343 | 62 | 85 | 65 |
| Manufactured iron | 290 | 144 | 115 | 208 | 418 | 133 | 153 | 171 |
| Produce | 534 | 107 | 118 | 106 | 236 | 66 | 100 | 100 |
| General and miscellaneous | 14,882 | 9,505 | 8,646 | 10,663 | 6,500 | 5,219 | 4,125 | 7,179 |
| Total | 113,823 | 122,185 | 84,498 | 125,722 | 95,353 | 108,517 | 57,612 | 113,674 |
| Number of passengers | 8,900 | 7,110 | 5,075 | 7,822 | 6,285 | 3,789 | 4,265 | 5,865 |

| Articles. | Lock No. 3. | | | | Lock No. 4. | | | |
|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. |
| Coal | 46,409 | 47,026 | 27,243 | 40,850 | 44,430 | 42,078 | 26,467 | 42,353 |
| Grain | 6,877 | 6,242 | 2,704 | 3,255 | 7,645 | 6,432 | 2,325 | 3,293 |
| Salt | 443 | 1,221 | 286 | 174 | 345 | 634 | 177 | 139 |
| Oil | 176 | 153 | 104 | 87 | 186 | 154 | 71 | 84 |
| Whisky | 1,387 | 1,198 | 1,114 | 1,351 | 1,207 | 1,106 | 1,572 | 1,303 |
| Flour | 414 | 360 | 636 | 1,040 | 311 | 321 | 503 | 947 |
| Sugar | 115 | 73 | 86 | 70 | 68 | 44 | 83 | 57 |
| Molasses | 80 | 40 | 33 | 19 | 66 | 39 | 21 | 12 |
| Cement | 240 | 90 | 428 | 367 | 179 | 100 | 539 | 269 |
| Tobacco | 1,103 | 1,209 | 1,145 | 614 | 432 | 396 | 266 | 193 |
| Hay | 351 | 123 | 524 | 162 | 352 | 118 | 505 | 141 |
| Live stock | 231 | 194 | 179 | 400 | 183 | 79 | 71 | 221 |
| Lumber and timber | 27,783 | 35,733 | 19,000 | 51,577 | 23,204 | 36,925 | 18,528 | 51,368 |
| Shingles | 138 | 67 | 46 | 35 | 177 | 61 | 21 | 31 |
| Manufactured iron | 268 | 33 | 197 | 135 | 143 | 16 | 102 | 132 |
| Produce | 66 | 18 | 102 | 40 | 139 | 18 | 52 | 31 |
| General and miscellaneous | 4,785 | 9,981 | 3,911 | 4,416 | 4,938 | 3,610 | 5,368 | 4,022 |
| Total | 90,866 | 103,761 | 57,738 | 104,592 | 84,005 | 92,131 | 56,671 | 104,596 |
| Number of passengers | 4,367 | 1,681 | 3,732 | 4,773 | 4,167 | 1,973 | 3,884 | 4,787 |

| Articles. | Lock No. 5. | | | | Lock No. 6. | | | |
|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. |
| Coal | 13,664 | 15,392 | 9,605 | 10,001 | 7,273 | 6,390 | 5,027 | 4,186 |
| Grain | 5,840 | 4,666 | 2,254 | 2,715 | 5,445 | 3,764 | 2,349 | 2,728 |
| Salt | 150 | 231 | 133 | 79 | 89 | 168 | 68 | 81 |
| Oil | 41 | 58 | 22 | 18 | 27 | 64 | 9 | 18 |
| Whisky | 1,622 | 1,194 | 1,217 | 1,290 | 1,235 | 935 | 1,086 | 1,256 |
| Flour | 60 | 112 | 111 | 167 | 56 | 85 | 124 | 162 |
| Sugar | 11 | 15 | 11 | 16 | 8 | 11 | 10 | 15 |
| Molasses | 13 | 23 | 4 | 3 | 13 | 17 | 3 | 3 |
| Cement | 70 | 60 | 125 | 43 | 65 | 35 | 80 | 38 |
| Tobacco | 273 | 282 | 70 | 158 | 156 | 170 | 82 | 52 |
| Hay | 143 | 21 | 449 | 147 | 26 | 10 | 445 | 122 |
| Live stock | 74 | 46 | 39 | 183 | 43 | 56 | 5 | 176 |
| Lumber and timber | 95,172 | 123,757 | 80,346 | 105,051 | 96,983 | 124,785 | 77,665 | 114,680 |
| Shingles | 147 | 21 | 13 | ........ | 2 | 19 | 1 | 2 |
| Manufactured iron | 68 | 8 | 33 | 113 | 67 | 11 | 6 | 112 |
| Produce | 10 | 4 | 50 | 10 | 8 | 2 | 10 | 10 |
| General and miscellaneous | 2,353 | 1,244 | 1,351 | 6,701 | 1,696 | 823 | 1,058 | 3,240 |
| Total | 119,711 | 147,134 | 95,833 | 126,695 | 113,192 | 137,345 | 87,973 | 126,881 |
| Number of passengers | 3,300 | 3,139 | 2,802 | 4,016 | 3,196 | 4,017 | 3,640 | 4,814 |

*Statement of commerce, in tons, passing the locks on Kentucky River, Kentucky, during the calendar years 1900, 1901, 1902, and 1903.*

| Articles. | Lock No. 7. | | | | Lock No. 8. | | | | Lock and Dam No. 9, 1903.[a] |
|---|---|---|---|---|---|---|---|---|---|
| | 1900. | 1901. | 1902. | 1903. | 1900. | 1901. | 1902. | 1903. | |
| Coal | 6,525 | 5,017 | 5,027 | 3,885 | 163 | 1,453 | 1,031 | 1,570 | ........ |
| Grain | 4,786 | 4,433 | 1,957 | 2,467 | 6 | 16 | 185 | 92 | ........ |
| Salt | 100 | 171 | 71 | 56 | 21 | 102 | 70 | 30 | ........ |
| Oil | 13 | 49 | 5 | 69 | ........ | 15 | 5 | 4 | ........ |
| Whisky | 1,322 | 980 | 743 | 1,197 | ........ | 41 | ........ | 3 | ........ |
| Flour | 34 | 78 | 55 | 106 | 3 | 89 | 14 | 56 | ........ |
| Sugar | 2 | 6 | 3 | 8 | 1 | 3 | ........ | 1 | ........ |
| Molasses | 4 | 7 | ........ | ........ | ........ | 2 | ........ | ........ | ........ |
| Cement | 123 | 18 | 82 | 22 | 5 | 12 | ........ | 95 | ........ |
| Tobacco | 87 | 88 | 20 | 11 | 4 | 76 | ........ | 10 | ........ |
| Hay | 29 | 5 | 442 | 123 | ........ | 1 | ........ | ........ | ........ |
| Live stock | 45 | 64 | 19 | 139 | 10 | 25 | 8 | 93 | ........ |
| Lumber and timber | 99,463 | 123,822 | 83,369 | 101,149 | 8,023 | 140,902 | 111,795 | 129,798 | 40 |
| Shingles | 10 | 9 | ........ | ........ | ........ | 2 | ........ | ........ | ........ |
| Manufactured iron | 115 | 19 | 2 | 107 | 1 | 15 | 4 | 101 | ........ |
| Produce | 13 | 6 | ........ | ........ | 10 | 12 | ........ | ........ | ........ |
| General and miscellaneous | 14,734 | 756 | 1,296 | 1,684 | 101 | 4,346 | 570 | 383 | 2 |
| Total | 127,405 | 136,473 | 93,101 | 111,023 | 8,348 | 147,062 | 113,682 | 132,236 | 42 |
| Number of passengers | 2,816 | 3,663 | 2,992 | 4,462 | 142 | 1,854 | 1,475 | 3,447 | 14 |

[a] The first boat passed through Lock No. 9, December 21, 1903.

*List of boats plying the Kentucky River, Kentucky, during calendar year ending December 31, 1903.*

| Name of boat. | Character. | Length. | Breadth. | Depth. | Tonnage. |
|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | |
| Genl. O. M. Poe | United States towboat | 145.60 | 34.0 | 4.6 | 150.00 |
| Pearl | United States launch | 40.00 | 8.0 | 4.0 | 5.00 |
| Falls City | Packet | 151.67 | 36.0 | 4.4 | 235.00 |
| Golden Gate | do | 131.40 | 30.0 | 4.0 | 142.00 |
| White Dove | do | 65.00 | 14.0 | 3.0 | 35.00 |
| Juniata | do | 45.00 | 18.0 | 2.8 | 22.00 |
| Bellevue | Towboat | 135.00 | 27.0 | 3.5 | 89.00 |
| Mildred | do | 116.00 | 24.0 | 3.0 | 92.00 |
| Al Martin[a] | do | 112.00 | 23.0 | 4.0 | 96.00 |
| E. T. Slider | do | 110.00 | 24.0 | 3.5 | 92.00 |
| Reba Reeves | do | 105.40 | 21.8 | 3.4 | 68.00 |
| Raymond | do | 102.60 | 22.0 | 3.0 | 67.02 |
| Mary Stewart | do | 100.00 | 20.0 | 3.2 | 91.02 |
| Innovator | do | 100.00 | 20.0 | 3.0 | 62.00 |
| Louisa | do | 91.00 | 12.0 | 2.5 | 24.00 |
| Vivian | do | 90.00 | 21.0 | 3.8 | 75.00 |
| Samuel | do | 80.00 | 16.0 | 3.0 | 48.00 |
| Gladys | do | 76.00 | 11.0 | 2.6 | 60.00 |
| Minnie | do | 73.00 | 16.0 | 2.8 | 63.00 |
| Blue Wing | do | 62.00 | 11.0 | 1.5 | 40.00 |
| Louise | do | 60.40 | 9.5 | 2.0 | 9.00 |
| John W. Thomas | do | 60.00 | 12.0 | 3.4 | 13.00 |
| Charley Boy No. 2 | do | 58.00 | 10.5 | 2.6 | 44.96 |
| Fannie | do | 55.00 | 11.0 | 2.4 | 10.00 |
| Three Friends | do | 56.00 | 8.0 | 2.0 | 5.00 |
| Dove | do | 47.00 | 8.0 | 1.5 | 18.00 |
| Gunther | do | 30.00 | 7.0 | 3.5 | 4.50 |
| Champion | Sawmill boat | 90.00 | 26.0 | 4.5 | 69.00 |
| Polly | Pleasure boat | 82.00 | 12.0 | 2.5 | 30.00 |
| Eileen | do | 80.00 | 14.0 | 2.5 | 35.00 |
| Henry H | do | 50.00 | 14.0 | 2.8 | 15.00 |
| Ramona | do | 71.00 | 12.0 | 2.5 | 12.00 |
| Willametta | do | 40.00 | 8.0 | 3.6 | 10.00 |
| Viola | do | 38.00 | 7.0 | 3.0 | 5.00 |
| Merry Huston | do | 32.00 | 8.0 | 4.6 | 4.00 |
| Edna Roberts | do | 32.00 | 6.0 | 4.0 | 2.00 |
| Will S. Hayes | do | 31.00 | 8.0 | 3.0 | 2.00 |
| Eulalie | do | 31.00 | 6.0 | 4.5 | 3.00 |
| Katherine L | do | 30.00 | 7.0 | 3.5 | 5.00 |

[a] The steamer Al Martin sprung a leak December 12, 1903, and was sunk in pool No. 3.

*List of boats plying the Kentucky River, Kentucky, during calendar year ending December 31, 1903*—Continued.

| Name of boat. | Character. | Length. | Breadth. | Depth. | Tonnage. |
|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | |
| Rover | Pleasure boat | 30.00 | 9.0 | 2.0 | 2.00 |
| Automatic | do | 30.00 | 8.0 | 2.5 | 3.00 |
| Juanita | do | | | | |
| Pomona | do | | | | |
| Ione | do | | | | |
| Dupont | do | | | | |
| Bernadotte | do | | | | |
| Sarah | do | | | | |
| Emma May | do | | | | |
| Monita | do | | | | |
| Clara L | do | | | | |
| Helen | do | | | | |
| Shamrock | do | | | | |

Where no dimensions are given the boats are small gasoline launches.

*List of leases in force during the fiscal year ending June 30, 1904, Kentucky River, Kentucky*

Location: Lock No. 4.
Lessee: Kentucky River Mills.
Dated: July 10, 1878.
Expires: July 10, 1977.
Annual rental: $180.

## G G 8.

## PRELIMINARY EXAMINATION OF MUSKINGUM RIVER, OHIO, FROM ZANESVILLE TO COSHOCTON.

[Printed in House Doc. No. 241, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 9, 1903.*

Sir: I have the honor to submit herewith a report, dated August 8, 1902, by Maj. E. H. Ruffner, Corps of Engineers, on preliminary examination of Muskingum River from Zanesville to Coshocton, with a view of obtaining a navigable depth of 6 feet, ordered by the river and harbor act of June 13, 1902.

The object of the proposed improvement is to extend the existing slack water on this stream up to Coshocton, with a view of effecting a connection there with the Ohio Canal. Muskingum River is connected with the Ohio Canal by a side cut at Dresden, Ohio, a point between Coshocton and the present head of slack-water navigation on the river, and a plan for extending slack water to Dresden was submitted to Congress in the Annual Report of the Chief of Engineers for 1895, page 2390. Under this plan connection can be made through the existing side cut at much less expense than contemplated by the improvement now proposed.

While Major Ruffner is not prepared to say that the improvement of the river from Zanesville to Coshocton would not produce adequate commercial results, he expresses the opinion that this could be determined by actual experience by the less costly project of extending navigation first from Zanesville to Dresden, and that it would be perfectly practicable and wise to postpone the further extension to Coshocton for the present. Col. G. J. Lydecker, Corps of Engineers, the division engineer, concurs in his views.

The Board of Engineers for Rivers and Harbors, which has reviewed this report, under the provisions of sections 3 and 14 of the above-mentioned act, in report of March 26, 1903, agrees with the district officer that it is inadvisable to extend the improvement of the Muskingum River to Coshocton, and states that unless the side cut be deepened without expense to the United States no sufficient reason exists for extending slack-water improvement even as far as Dresden.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS.

Engineer Office, United States Army,
*Cincinnati, Ohio, August 8, 1902.*

General: I have been charged by circular with making a preliminary examination in accordance with the act of Congress approved June 13, 1902, of the following locality:

Ohio—Muskingum River from Zanesville to Coshocton, with a view to obtaining a navigable depth of 6 feet.

Under the provisions of the river and harbor act of August 18, 1894, an instrumental survey was made of a part of this distance, from Zanesville to Dresden, 15 miles. (See Annual Report of the Chief of Engineers for 1895, p. 2390.) From the information gained by this survey, which is full and complete, it is ascertained that it will require one dam above Zanesville to provide a navigable depth of 6 feet for a distance of 15 miles above Zanesville, and that the average width of the river below Dresden is 450 feet. It was estimated that a lock and dam could be built for $110,000 which would carry the present slack-water system to Dresden, to connect there with the Ohio Canal. Although this report was made seven years ago, no action seems to have been taken by Congress in the matter.

The condition of the river above Dresden is similar to that below. Its width at Coshocton is but little less than at Dresden; it is devoid of rapids and the fall of the low-water surface can not be greater than 1.5 feet to the mile. The bottom lands along the upper stretch of the river are wide and very fertile and subject to overflow at a few points only. Two dams above Dresden, similar in construction and lift to the one proposed below Dresden, would probably extend the 6 feet of navigable depth to the head of the river through this 17 miles.

It is quite safe to say that $220,000 would cover the cost of these two additional locks and dams, and the question then would be, whether the commerce now on the Muskingum River, or possible commerce, would justify this proposed improvement.

The statistics for the Muskingum River are erratic and variable. There is little or no through commerce. There are a few boats that ply on one portion of the river, and some on another portion. The upper locks, 8, 9, and 10, show the greatest business, and the central locks show very little. There is, so to speak, no permanent business from the Muskingum River up or down the Ohio.

There is inclosed a tabulated statement of the lockages at 8, 9, and 10 during the last ten years, the only ones for which this information is given. There is also furnished the same information in average, and shown upon a chart. From this it is seen that the movement of freight through this part of the river does not and never did aggregate 100,000 tons for a year—that it keeps about an average; and by examining the cost to the United States of a portion of the Muskingum River in 1901, it is shown to be 73 cents for each ton of freight moved on this river. It seems quite evident that the Muskingum River traffic is neither productive nor increasing. The question then comes up, Will it increase because of the proposed improvement above Zanesville? The assistant engineer in charge reports that traffic on the river above Zanesville, Ohio, is at present limited to small pleasure craft, although, as a matter of course, the pool is navigable and, if business required it, could be used under any circumstances that made it desirable that freight to and from Zanesville should go by river instead of otherwise. The freight that goes down the river originates in the upper pool at Zanesville, and is taken on and discharged from the canal at Zanesville. This freight is varied, and is, in general, listed as merchandise, the principal item, and sand and stone the next. Although the Muskingum River in part is fortunate in having good coal on its banks, there is no shipment of coal, to speak of, by the river—less than 1,000 tons being reported for either of the latter two years.

The question of the relation between the river and the Ohio Canal is an interesting one. At present there are some 75 boats operating on that canal between Coshocton and Cleveland. During the year 1900 a movement of some 80,000 tons or over is reported. The total outgoing and incoming freight by railroad at Zanesville is some ten times this amount. If there were any real reason for thinking that this freight or any part thereof would be deflected to the river, some indication should have been exhibited during the past seven years, when it was constantly reported that, at a cost of $110,000, connection could be made with the Ohio Canal and Zanesville by the building of Lock No. 11.

ineers appointed by the Secretary of War, under river and harbor act of August 18, 1894, to make certain surveys and report relative to a continuous canal connecting Lake Erie with the Ohio River, estimated that the commerce in ore and coal interchanged between the Lake and the Ohio would be the largest interest served by a waterway, and, in the case of a route from Cleveland to Marietta, 40 per cent would be divided up into stone, clay products, agricultural products, and local shipments of coal. But as barges suitably adapted to the navigation of the lakes in the ore and coal traffic could not navigate the canal or river, the benefit of the proposed through waterway from the Ohio to the lake would be restricted to an increase of the class of freight now carried over the Muskingum River and Ohio Canal.

The cost of the survey from Dresden to Coshocton and preparation of maps and estimates would be about $2,000.

At Dresden the Muskingum River is connected with the Ohio Canal by a side cut 2¼ miles in length. This canal runs from Portsmouth, in the Ohio River, to Cleveland, on Lake Erie. The pool of the side cut is at an elevation of 25.6 feet above present low water in the Muskingum, which descent is overcome by three locks.

It is quite evident that should the project suggested in 1895 be carried out, and Lock and Dam No. 11 be built, at a cost of $110,000, experience would show whether or not any commerce would develop between Zanesville and the Ohio Canal, and, therefore, it seems quite premature to say that conditions would be different by extending this slack-water navigation in the river to Coshocton at three times this expense, when, at present, there is no sign anywhere of an increase in the traffic on the Muskingum, or probability of any in case the connection with the Ohio Canal was secured.

For these reasons I am constrained to say that although I could not say that the improvement of the Muskingum River from Zanesville to Coshocton was not desirable, or would not produce adequate commercial results, I am of the opinion that this could be determined by actual experience by the lesser project of extending, first, the navigation from Zanesville to Dresden, and that it would be perfectly practicable and wise to postpone the further extension to Coshocton, for the present, at any rate.

Very respectfully, your obedient servant,

E. H. Ruffner,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, August 9, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

I concur in the views expressed by Major Ruffner in the concluding paragraph of the within report.

G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 15, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 26, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer, the indorsement of the division engineer thereon, and several letters from interested persons.

The commerce now existing on the Muskingum River is not sufficient to justify an extension of the improvement, nor is it probable that any increase would develop on the river itself were slack water carried to Coshocton. The only argument for such an extension is that a connection would thereby be effected with the Ohio Canal, and a through route from Lake Erie to the Ohio River would thereby be created.

The depth in the Ohio Canal is only 4 feet, and the existing commerce near Coshocton is small.

A connection with the canal can be made at Dresden, between Zanesville and Coshocton, where a side cut extends from the main canal to the Muskingum River. This side cut contains three locks, and has now an available depth of but 2½ feet.

The Muskingum River improvement formerly extended as far as Dresden, there having been a lock and dam above Zanesville, which was in ruins at the time of the transfer of the works to the General Government. A depth of 6 feet to Dresden can be restored by a single lock and dam at or near Symmes Creek. A survey for this part of the river was ordered in 1894, and has been before Congress since 1895, without favorable action by that body.

The Board agrees with the district officer that it is inadvisable to extend the Muskingum River improvement to Coshocton, since the only result which could justify this measure can be accomplished at far less expense by an extension to Dresden, and a deepening of the side-cut canal. The expense of the work in the canal should not be at the charge of the General Government. Unless the side cut be deepened, no sufficient reason exists for extending slack-water improvement even as far as Dresden.

**For the Board:**

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

*Commercial statistics, Muskingum River, Ohio.*

| Year. | Lock No. | Number of crafts. | | | | Lockages. | Freight. | Passengers. |
|---|---|---|---|---|---|---|---|---|
| | | Steamboats. | Barges. | Miscellaneous. | Total. | | | |
| | | | | | | | *Tons.* | |
| 1892 | 8 | 534 | 20 | 18 | 572 | 565 | 31,107 | 31,368 |
| | 9 | 562 | 64 | 38 | 664 | 644 | | |
| | 10 | 721 | 21 | 3 | 745 | 730 | | |
| 1893 | 8 | 763 | 57 | 129 | 949 | 914 | 80,186 | 49,160 |
| | 9 | 754 | 86 | 193 | 1,033 | 920 | | |
| | 10 | 723 | 91 | 14 | 828 | 740 | | |
| 1894 | 8 | 840 | 60 | 95 | 995 | 966 | 51,915 | 49,897 |
| | 9 | 844 | 60 | 187 | 1,091 | 1,023 | | |
| | 10 | 836 | 199 | 8 | 1,043 | 1,026 | | |
| 1895 | 8 | 827 | 33 | 141 | 1,001 | 993 | 86,711 | 38,267 |
| | 9 | 906 | 77 | 126 | 1,109 | 1,039 | | |
| | 10 | 876 | 162 | 15 | 1,053 | 1,010 | | |
| 1896 | 8 | 751 | 33 | 76 | 860 | 851 | 59,597 | 42,470 |
| | 9 | 760 | 73 | 103 | 936 | 892 | | |
| | 10 | 738 | 62 | 14 | 814 | 794 | | |
| 1897 | 8 | 798 | 93 | 72 | 963 | 900 | 65,473 | 72,512 |
| | 9 | 826 | 71 | 131 | 1,028 | 934 | | |
| | 10 | 774 | 87 | 17 | 878 | 832 | | |
| 1898 | 8 | 1,456 | 47 | 63 | 1,566 | 1,517 | 83,077 | 68,056 |
| | 9 | 1,526 | 78 | 109 | 1,713 | 1,624 | | |
| | 10 | 1,504 | 77 | 11 | 1,592 | 1,544 | | |
| 1899 | 8 | 1,321 | 58 | 80 | 1,459 | 1,389 | 70,206 | 100,756 |
| | 9 | 1,380 | 58 | 74 | 1,512 | 1,437 | | |
| | 10 | 1,376 | 137 | 10 | 1,523 | 1,438 | | |
| 1900 | 8 | 1,380 | 79 | 59 | 1,518 | 1,480 | 78,595 | 116,599 |
| | 9 | 1,412 | 58 | 47 | 1,517 | 1,480 | | |
| | 10 | 1,435 | 332 | 10 | 1,797 | 1,690 | | |
| 1901 | 8 | 710 | 99 | 57 | 866 | 806 | 61,608 | 77,580 |
| | 9 | 743 | 68 | 42 | 853 | 791 | | |
| | 10 | 932 | 278 | 9 | 1,219 | 945 | | |

## H H 1.

## IMPROVEMENT OF FALLS OF OHIO RIVER AT LOUISVILLE, KENTUCKY.

A condensed description of the original condition, outline of projects, and references to more detailed information will be found on page 484 of this report.

Operations during the fiscal year were limited to drilling, blasting, and removing disrupted rock from that part of the enlargement at the head of the Louisville and Portland Canal, east of the former cross dam. On account of high water and ice, and the dredging plant being required so continuously for canal work, only 17,571 cubic yards, scow measure, disrupted rock were removed during the year. The two compressor scows worked between July 6 and September 17, 1903, and one compressor scow from November 2 to November 13, 1903, the work done being as follows:

| | | |
|---|---|---|
| Holes drilled | number | 7,947 |
| | linear feet | 25,012 |
| Blasts made | number | [a] 229 |
| Holes blasted | number | 6,447 |
| | linear feet | 23,180 |
| Exploders used | number | 6,442 |
| Dynamite used | pounds | 16,352 |
| Rock disrupted | cubic yards | 9,915 |

In removing the disrupted rock, three dredges worked at irregular intervals between July 10 and December 12, 1903, removing 17,571 cubic yards, scow measure, disrupted rock.

During the winter season, repairs were made to the compressor scows and to the steamer *Wave Rock*.

During a thunderstorm July 11, 1903, while the crew of drill scow *No. 2* was drilling and loading holes, 9 of the 26 loaded holes, each containing 2 pounds dynamite, exploded, probably caused by lightning striking the exploder wires. The scow was sunk, but was only slightly injured; the crew was not injured.

The items and quantities of work accomplished, as well as that remaining to be done on June 30, 1904, to complete the enlargement at the head of the canal, as proposed in the approved project, are shown in the following tabular statement:

| Items. | | Accomplished to June 30, 1904. | Remaining to be done June 30, 1904. |
|---|---|---|---|
| Earth excavation | cubic yards | 422,210.80 | 18,861.90 |
| Loose-rock excavation | do | 13,681.66 | 0.00 |
| Solid-rock excavation | do | 252,760.50 | [b] 10,662.60 |
| River wall, removal of | do | 21,753.89 | 0.00 |
| Masonry, new north wall | do | 16,120.50 | 0.00 |
| Old north wall, removal of | linear feet | 3,550.00 | 0.00 |
| New wall, south of canal | cubic yards | 0.00 | 3,801.00 |
| Slope revetment, south side of canal | square yards | 0.00 | 2,366.00 |
| Concrete dam | cubic yards | 5,897.50 | 0.00 |
| Guiding dike and cross dam, removal of | linear feet | 3,915.00 | 0.00 |
| Boulé dam | do | 600.00 | 0.00 |
| Guide buoys | number | 5.00 | 0.00 |
| Old wall and guard-gate abutment, removal of | cubic yards | 0.00 | 1,736.00 |

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[a] Of these blasts 128 were used in breaking up pieces of rock too large for dredges to handle.

[b] Also 15,531.8 cubic yards disrupted but not removed.

No appropriation for the additional work for Indiana Chute recommended in the report of a Board of Engineer Officers, approved December 30, 1901, has been made.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $32,962.46 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 25,045.71 |
| July 1, 1904, balance unexpended | 7,916.75 |
| July 1, 1904, outstanding liabilities | 703.61 |
| July 1, 1904, balance available | 7,213.14 |
| Amount (estimated) required for completion of existing project | 557,569.79 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 350,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| | | |
|---|---|---|
| Enlargement at head of canal and of basin at locks: | | |
| July 5, 1884 | $300,000 | |
| August 5, 1886 | 150,000 | |
| August 11, 1888 | 150,000 | |
| September 19, 1890 | 60,000 | |
| July 13, 1892 | 60,000 | |
| August 18, 1894 | 60,000 | |
| | | $780,000 |
| Appropriations for improving Falls of Ohio River and Indiana Chute, Falls of Ohio River: | | |
| June 3, 1896 | 10,000 | |
| June 4, 1897 | 350,000 | |
| July 1, 1898 | 152,250 | |
| March 3, 1899 | 15,000 | |
| June 13, 1902 | 41,000 | |
| | | 568,250 |
| Allotments for Indiana Chute from appropriations for improving Ohio River: | | |
| July 14, 1880 | 10,000 | |
| March 3, 1881 | 50,000 | |
| August 2, 1882 | 35,000 | |
| July 5, 1884 | 10,000 | |
| August 5, 1886 | 20,000 | |
| August 11, 1888 | 15,000 | |
| | | 140,000 |
| Appropriations for work on Indiana Chute: | | |
| September 19, 1890 | 25,000 | |
| July 13, 1892 | 35,000 | |
| August 18, 1894 | 20,000 | |
| | | 80,000 |
| Total | | 1,568,250 |

COMMERCIAL STATISTICS.

Commercial statistics are given in the report for operating and care of the Louisville and Portland Canal.

## H H 2.

## OPERATING AND CARE OF LOUISVILLE AND PORTLAND CANAL, KENTUCKY.

Description of original condition and references to former reports, documents, etc., will be found on page 489 of this report.

The project and estimate for the fiscal year ending June 30, 1904, approved July 24, 1903, provided as follows:

It is proposed to operate the canal and locks and to make such repairs as may from time to time become necessary to maintain them in good navigable condition: to operate the dredging outfit as needed in clearing the canal and locks of deposit, etc., brought into them by high water; to make such repairs to the towboat, dredges, buildings, walls, slopes, paving, roadways, bridges, fences, and other Government property as are necessary to maintain them in good serviceable condition.

Under this project and the estimate submitted therewith, the operations during the fiscal year, in addition to the usual work of passing traffic and ordinary current repairs incident to care and preservation, were as follows:

From the canal and entrances thereto and from the lock chambers there were dredged during the year 161,920 cubic yards mud; and in addition there were dredged for the city of Louisville and for the Byrne & Speed Coal Company, at their expense, 17,770 cubic yards mud, $245.63 for the use of plant being collected from the latter company and deposited to the credit of the Treasurer of the United States. The dredges also removed from the channel below the locks 3,570 cubic yards, scow measure, disrupted rock. The two drill scows working in the channel below the locks disrupted 2,636.9 cubic yards rock, measured in place. A new blacksmith shop was constructed by contracts. The slope revetment at Ninth street was done by hired labor. The boiler and engine house on south side of locks at the middle gates, which was badly damaged by fire on November 20, 1903, was repaired. On September 13, 1903, in raising and lowering the automatic gate, all the hold-down bolts of the lower leaf, two of the adjoining hinges, one section of hollow quoin, and fifteen of the sixteen hinges at the apex were broken. The repairs made necessary by this accident are practically complete.

The details of the various items of work done during the fiscal year are set forth in the report of Mr. J. H. Casey, assistant engineer, appended hereto.

Following are the statements of expenditures, collections, etc., for the year, together with a comparative statement of traffic and commerce passing Louisville, Ky., from 1877 to June 30, 1904:

*Summary of expenditures on account of operating and care of Louisville and Portland Canal, fiscal year 1904, showing general items and amount expended under each heading.*

| Item. | Amount. |
|---|---|
| Services | $62,355.83 |
| Supplies | 6,225.06 |
| Materials | 17,141.78 |
| Miscellaneous | 396.44 |
| Total | 86,119.11 |

### COLLECTIONS.

| | | |
|---|---|---|
| 1903. | | |
| Aug. 6. | Louisville and Evansville Packet Company, for use of dry dock | $84.59 |
| Oct. 19. | Speed Elevator Company, for rent of land | 125.00 |
| Nov. 28. | Louisville and Evansville Packet Company, for use of dry dock | 55.42 |
| Dec. 9. | Ohio River Sand Company, for use of dry dock | 55.83 |
| Dec. 16. | W. F. Nugent & Bro., for use of dry dock | 36.25 |
| 1904. | | |
| Jan. 4. | Louisville Cement Company, for rent of land | 30.00 |
| Jan. 13. | Union Cement and Lime Company, for rent of land | 5.00 |
| Mar. 4. | Louisville and Evansville Packet Company, for use of dry dock | 86.25 |
| Mar. 24. | Speed Elevator Company, for rent of land | 125.00 |
| May 16. | Byrne & Speed Coal Company, for use of dredging plant | 245.63 |
| | Total | 848.97 |

All of the above collections were deposited to the credit of the Treasurer of the United States.

### APPROPRIATIONS AND ALLOTMENTS.

*Appropriations.*

| | |
|---|---|
| Act of March 3, 1881 | $40,562.91 |

*Allotments.*

[From act of March 3, 1881.]

| | | | |
|---|---|---|---|
| Fiscal year— | | Fiscal year— | |
| 1882 | $54,105.66 | 1884 | $53,189.18 |
| 1883 | 61,333.14 | 1885 | 4,872.02 |

[From act of July 5, 1884.]

| | | | |
|---|---|---|---|
| ———, 1884 | $67,496.56 | November 27, 1894 | $1,500.00 |
| August 3, 1885 | 91,480.00 | July 11, 1895 | 112,838.28 |
| July 28, 1886 | 82,320.00 | July 28, 1896 | 123,715.05 |
| July 2, 1887 | 77,805.00 | July 23, 1897 | 67,311.47 |
| July 13, 1888 | 99,456.79 | July 15, 1898 | 62,061.71 |
| July 20, 1889 | 93,744.00 | July 19, 1899 | 78,422.89 |
| July 19, 1890 | 55,548.88 | July 18, 1900 | 78,590.05 |
| July 17, 1891 | 78,769.38 | July 17, 1901 | 108,550.20 |
| July 20, 1892 | 1 2,175.94 | July 30, 1902 | 118,732.34 |
| July 13, 1893 | 77,158.68 | July 24, 1903 | 43,484.66 |
| September 9, 1893 | 2,000.00 | | |
| July 11, 1894 | 114,528.08 | Total | 1,962,112.87 |

### COMMERCIAL STATISTICS.

*Statement of traffic through the Louisville and Portland Canal from July 1, 1903, to June 30, 1904.*

| Kind of craft. | Number. | Tonnage. |
|---|---|---|
| Passenger boats | 519 | 165,001 |
| Towboats | 900 | 126,153 |
| Government boats | 335 | 27,407 |
| Coal barges | 2,834 | 903,712 |
| Other barges | 601 | 118,887 |
| Small craft | 306 | 809 |
| Rafts | 5 | 1,220 |
| Total | 5,500 | 1,343,189 |

Total number of lockages during the past fiscal year, 2,329.

*Statement of traffic through the open river channel over the Falls of the Ohio River at Louisville, Ky., from July 1, 1903, to June 30, 1904.*

| Kind of craft. | Number. | Tonnage. |
|---|---|---|
| Passenger boats | 87 | 38,026 |
| Towboats | 471 | 67,633 |
| Government boats | 10 | 577 |
| Coal boats and barges | 921 | 306,140 |
| Small craft | 10 | 480 |
| Rafts | 1 | ........... |
| Total | 1,500 | 412,856 |

*Statement of commerce through the Louisville and Portland Canal from July 1, 1903, to June 30, 1904.*

| Articles. | Quantity. | Articles. | Quantity. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Coal | 1,210,316¼ | Straw | 2,601½ |
| Corn | 1,263¾ | Cattle | 1,349 |
| Wheat | 2,988¾ | Sheep and swine | 1,598¼ |
| Salt | 4,996¼ | Horses and mules | 377¼ |
| Oil | 871¼ | Lumber | 41,715¼ |
| Whisky | 1,678¾ | Staves and shingles | 5,686 |
| Flour | 293¼ | Steel rails | 2,077 |
| Sugar | 540¼ | Iron ore and manufactured iron | 19,998 |
| Molasses | 222¾ | Produce | 1,756¼ |
| Cement | 808 | Miscellaneous | 39,019¾ |
| Tobacco | 1,440 | | |
| Cotton | 113 | Total | 1,349,371¼ |
| Hay | 7,659¾ | | |

Number of passengers, 14,305.

*Through open river channel.*

| Articles. | Quantity. | Articles. | Quantity. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Coal | 498,807 | Hay and straw | 2,020¼ |
| Corn and wheat | 332¼ | Stock | 507¼ |
| Salt | 175 | Lumber | 11,361¾ |
| Oil | 192¼ | Staves and shingles | 3,558¼ |
| Whisky | 160 | Steel rails | 1 |
| Flour | 107¼ | Iron ore and manufactured iron | 14,350 |
| Sugar and molasses | 168¼ | Produce | 91¼ |
| Cement | 183¾ | Miscellaneous | 9,636¼ |
| Tobacco | 324¾ | | |
| Cotton | 38¼ | Total | 542,015¾ |

## *Comparative statement of traffic and commerce, Louisville, Ky.*

### TRAFFIC.

| Fiscal year. | Via Louisville and Portland Canal. | | | | | Via open river. | | | | | Aggregate. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Passenger boats. | Tow-boats. | Coal boats and barges. | Miscellaneous. | Total. | Passenger boats. | Tow-boats. | Coal boats and barges. | Miscellaneous. | Total. | |
| 1877 | 795 | 295 | 2,185 | 164 | 3,439 | ........ | ........ | ........ | ........ | ........ | ........ |
| 1878 | 895 | 487 | 3,232 | 158 | 4,772 | ........ | ........ | ........ | ........ | ........ | ........ |
| 1879 | 804 | 293 | 1,227 | 258 | 2,582 | ........ | ........ | ........ | ........ | ........ | ........ |
| 1880 | 862 | 235 | 2,205 | 416 | 3,718 | ........ | ........ | ........ | ........ | ........ | ........ |
| 1881 | 1,088 | 407 | 2,559 | 142 | 4,196 | 272 | 325 | 1,126 | ........ | 1,723 | 5,919 |
| 1882 | 617 | 610 | 2,545 | 192 | 3,964 | 376 | 491 | 1,166 | 10 | 2,543 | 6,507 |
| 1883 | 1,069 | 769 | 2,784 | 329 | 4,954 | 256 | 239 | 935 | 45 | 1,475 | 6,429 |
| 1884 | 754 | 645 | 2,663 | 284 | 4,346 | 221 | 242 | 1,219 | 3 | 1,685 | 6,031 |
| 1885 | 742 | 772 | 3,086 | 386 | 4,986 | 116 | 136 | 551 | ........ | 803 | 5,789 |
| 1886 | 774 | 856 | 3,016 | 414 | 5,057 | 172 | 330 | 1,166 | 1 | 1,669 | 6,726 |
| 1887 | 700 | 847 | 2,904 | 318 | 4,769 | 354 | 555 | 1,551 | ........ | 2,460 | 7,229 |
| 1888 | 850 | 937 | 3,293 | 391 | 5,471 | 261 | 385 | 1,229 | ........ | 1,875 | 7,346 |
| 1889 | 1,076 | 767 | 4,632 | 363 | 6,838 | 502 | 113 | 380 | ........ | 995 | 7,833 |
| 1890 | 504 | 629 | 2,395 | 412 | 3,940 | 688 | 914 | 2,456 | ........ | 4,058 | 7,998 |
| 1891 | 590 | 836 | 3,197 | 254 | 4,877 | 534 | 513 | 1,619 | ........ | 2,666 | 7,543 |
| 1892 | 606 | 1,008 | 4,065 | 352 | 6,029 | 344 | 469 | 1,097 | ........ | 1,910 | 7,939 |
| 1893 | 573 | 786 | 1,926 | 499 | 3,784 | 228 | 502 | 986 | ........ | 1,716 | 5,500 |
| 1894 | 744 | 871 | 3,635 | 603 | 5,853 | 136 | 100 | 242 | ........ | 478 | 6,331 |
| 1895 | 622 | 536 | 2,124 | 673 | 3,955 | 103 | 248 | 586 | 5 | 942 | 4,897 |
| 1896 | 650 | 758 | 2,930 | 631 | 4,969 | 125 | 267 | 560 | 2 | 954 | 5,923 |
| 1897 | 675 | 732 | 2,658 | 641 | 4,706 | 309 | 591 | 1,365 | 30 | 2,295 | 7,001 |
| 1898 | 587 | 879 | 2,851 | 726 | 5,043 | 171 | 434 | 933 | 67 | 1,605 | 6,648 |
| 1899 | 562 | 854 | 2,799 | 873 | 5,088 | 216 | 665 | 1,452 | 132 | 2,465 | 7,553 |
| 1900 | 694 | 988 | 3,256 | 785 | 5,723 | 94 | 201 | 366 | 86 | 747 | 6,470 |
| 1901 | 613 | 948 | 3,287 | 733 | 5,581 | 184 | 620 | 1,543 | 109 | 2,456 | 8,037 |
| 1902 | 600 | 788 | 2,463 | 891 | 4,742 | 132 | 638 | 987 | 127 | 1,884 | 6,626 |
| 1903 | 507 | 863 | 3,052 | 657 | 5,079 | 210 | 815 | 1,553 | 65 | 2,643 | 7,722 |
| 1904 | 519 | 900 | 3,435 | 646 | 5,500 | 87 | 471 | 921 | 21 | 1,500 | 7,000 |

### COMMERCE.

| Fiscal year. | Via Louisville and Portland Canal. | | | Via open river. | | | Aggregate. |
|---|---|---|---|---|---|---|---|
| | Coal. | Other freight. | Total. | Coal. | Other freight. | Total. | |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1881 | 551,555 | 56,120 | 607,675 | 553,717 | 8,550 | 562,267 | 1,169,942 |
| 1882 | 431,224 | 37,328 | 468,552 | 704,210 | 22,998 | 727,208 | 1,195,760 |
| 1883 | 657,829 | 17,294 | 675,123 | 507,452 | 11,588 | 519,040 | 1,194,163 |
| 1884 | 460,787 | 57,762 | 518,549 | 692,778 | 8,750 | 701,528 | 1,220,077 |
| 1885 | 928,038 | 23,034 | 951,072 | 223,174 | 1,200 | 224,374 | 1,175,446 |
| 1886 | 729,543 | 25,176 | 754,719 | 619,704 | 7,600 | 627,304 | 1,382,023 |
| 1887 | 987,330 | 151,894 | 1,139,224 | 716,486 | 30,770 | 747,256 | 1,886,480 |
| 1888 | 1,216,458 | 332,294 | 1,548,752 | 407,390 | 37,269 | 444,659 | 1,993,411 |
| 1889 | 2,137,923 | 503,958 | 2,641,881 | 105,868 | 23,837 | 129,705 | 2,771,586 |
| 1890 | 391,757 | 226,303 | 618,060 | 1,016,198 | 118,678 | 1,134,876 | 1,752,936 |
| 1891 | 1,005,796 | 2,938,751 | 3,944,547 | 677,342 | 69,895 | 747,237 | 4,691,784 |
| 1892 | 1,232,998 | 387,588 | 1,620,586 | 482,310 | 69,765 | 552,075 | 2,172,661 |
| 1893 | 344,412 | 193,052 | 537,464 | 482,464 | 63,089 | 545,553 | 1,083,017 |
| 1894 | 1,153,577 | 245,200 | 1,398,777 | 134,748 | 9,842 | 144,590 | 1,543,367 |
| 1895 | 569,921 | 160,735 | 730,656 | 382,014 | 24,812 | 406,826 | 1,137,482 |
| 1896 | 1,006,707 | 291,611 | 1,298,318 | 390,260 | 35,834 | 426,094 | 1,724,412 |
| 1897 | 813,661 | 272,144 | 1,085,805 | 730,645 | 89,254 | 819,899 | 1,905,704 |
| 1898 | 852,450 | 262,542 | 1,114,992 | 501,937 | 43,756 | 545,693 | 1,660,685 |
| 1899 | 741,898 | 236,323 | 978,221 | 763,844 | 94,987 | 858,831 | 1,837,052 |
| 1900 | 1,027,616 | 299,101 | 1,326,717 | 238,458 | 23,530 | 261,988 | 1,588,705 |
| 1901 | 937,743 | 279,163 | 1,216,906 | 905,037 | 100,740 | 1,005,777 | 2,222,683 |
| 1902 | 489,627 | 358,083 | 847,710 | 530,320 | 94,515 | 624,835 | 1,472,545 |
| 1903 | 768,804 | 224,095 | 992,898 | 934,648 | 108,881 | 1,043,529 | 2,036,427 |
| 1904 | 1,210,316 | 139,055 | 1,349,371 | 498,807 | 41,209 | 542,016 | 1,891,387 |

## REPORT OF MR. J. H. CASEY, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
LOUISVILLE AND PORTLAND CANAL,
*Louisville, Ky., July 7, 1904.*

CAPTAIN: I have the honor to submit the following report of operations for operating and care of Louisville and Portland Canal, during the fiscal year ending June 30, 1904:

The canal was open to navigation during the year 325 days, and closed 41 days: 2 days in September, 1903, on account of accident to automatic gate; 15 days in January, 15 days in March, and 9 days in April, 1904, on account of ice and high water.

From December 14 to 31, inclusive, navigation was suspended on account of ice in the river. The canal was used by our floating plant and private boats as an ice harbor.

The highest stage of water occurred March 28, 1904, when the upper gauge read 22.9, and the lower gauge 48.4; the lowest stage was on December 20, 1903, the upper gauge reading 2.8, and the lower gauge 4.2 feet.

The Boulé dam at head of canal was raised May 24 and 25, and June 13 and 14, 1904, and lowered December 15, 1903, and May 31, 1904.

The Kentucky Chute dam was raised between August 14 and 21, September 19 and 21, and November 6, 1903; was lowered September 4, October 15, and November 19, 1903.

The lock force operated lock gates, mowed grass from slopes and grounds, painted smoke stacks, grouted revetment south side of locks, assisted in putting in temporary dam at Fourteenth street, washed mud from walls, revetments and lock engine houses after each high water, and made the necessary repairs to gates, chains, and machinery, used in operating the lock gates. Operated automatic gate 127 hours during July, August, and September, 1903; closed guard gates March 8 and 26, and opened them March 14 and April 4, 1904.

The regular employees in the carpenter, blacksmith, and machine shops made the necessary repairs to towboat, dredges, barges, etc., and repaired office boat for use on Wabash River; also made repairs September, 1903, and April, 1904, to propeller blade and gasoline engine for launch *Pearl* used on Kentucky River.

* * * * * * *

### TOWBOATS AND DREDGES.

The towboat *Major Mackenzie* towed scows, etc., for dredges while working in the canal, the channel below locks and at head of canal for Falls of Ohio River was laid up on account of ice and high water 38 days, and on account of repairs and replacing old steam drum 98 days; 26 days of this time was caused by the failure of the Henry Vogt Machine Company to complete their work on the new steam drum within the required time. Night work was continued from July 1 to 25, August 17 to December 13, 1903, and from April 11 to June 30, 1904.

The towboat *Col. G. L. Gillespie,* was laid up in the lock basin and out of commission the greater part of the year. From September 10 to December 14 she worked in place of the *Major Mackenzie* while the latter was receiving a new steam drum. On February 25, 1904, left for Green and Wabash rivers, and returned March 11, 1904, in tow with office boat and barge.

Dredge *Louisville No. 1* was employed during the year dredging mud in canal east and west of guard gates, disrupted rock from channel below locks, and at head of canal for Falls of Ohio River; August 17 to 24, dredged in front of city wharf between First and Fourth streets, and May 4 to 6, dredged in canal basin used by Byrne and Speed Coal Company near Fourteenth street. Was laid up 28 days on account of repairs and 56 days on account of ice and high water. Night work was continued from July 1 to December 13, 1903, and April 11 to June 30, 1904.

| | Cubic yards. |
|---|---|
| Mud dredged from canal | 67,295 |
| Mud dredged from basin used by Byrne and Speed Coal Company | 3,375 |
| Mud dredged from city wharf | 6,410 |
| Rock dredged from channel below locks | 1,670 |
| Total | 78,750 |

Dredge *Louisville No. 2* dredged in canal east and west of guard gates, front of city wharf between First and Fourth streets, at head of canal for Falls of Ohio River, and in channel below locks. Was laid up on account of repairs 11 days, 65 days on account of ice and high water, and 5 days in raising and lowering Boulé dam. On April 20 commenced working at night, continuing to June 25.

| | Cubic yards. |
|---|---|
| Mud dredged from canal | 40,740 |
| Mud removed from in front of city wharf | 1,400 |
| Disrupted rock removed from channel below locks | 145 |
| Total | 42,285 |

Dredge *Wabash* removed mud from canal east and west of guard gates, from front of city wharf between First and Fourth streets, basin used by Byrne and Speed Coal Company at Fourteenth street, rock from channel below locks, and at head of canal for Falls of Ohio River. Was laid up on account of repairs 24 days and on account of ice and high water 78 days; during this time the boat crew put in check posts and filled up washouts on the south side of the canal between Fifteenth and Eighteenth streets, and cleaned up yard at Fourteenth street warehouse.

| | Cubic yards. |
|---|---|
| Mud dredged from canal | 53,885 |
| Mud dredged, basin used by Byrne and Speed Coal Company | 2,375 |
| Mud dredged in front of city wharf | 4,200 |
| Disrupted rock dredged from channel below locks | 1,755 |
| Total | 62,215 |

## REPAIRS.

Towboat *Major Mackenzie:* Rebuilt furnace and put in new cast-iron fire liners; repaired bulkhead and nosing; built new bulkhead in officer's cabin; made and put in new pillow blocks and rocker shafts for main engines; replaced old steam drum with new one; repaired ridge pole over boilers and braced same, and made minor repairs to wheel and rudders.

Towboat *Col. G. L. Gillespie:* Painted exterior of boat; overhauled and covered steam pipes; repaired wheel and roof and made new smokestacks to replace old ones.

Dredge *Louisville No. 1:* Made and put on one new dipper handle and one spud to replace old ones; repaired dipper, spud frictions, swinging and backing drum shafts, and backing drum; rolled flues in boiler, put on new rear spud shaft; made new knee fenders, fitted up new backing drum, and repaired plate at heel of crane.

Dredge *Louisville No. 2:* Made new flat boat to replace old one; repaired exhaust pipes, put in new decking, beams, gunwales, and cylinder timbers and new corner irons; made and put on one new dipper handle and one spud; put new timbers under swinging engine and made necessary repairs to machinery as required.

Dredge *Wabash:* Made two new dipper handles and one spud; fitted up new shafting and gears for swinging engine and straightened old ones; repaired hoisting drum, crane, capstan engine, and engine bed; fitted up sheaves to operate the boat with wire rope in place of chain, and put in new cylinder timbers.

Canal, shops, etc.: Repaired broken places in concrete dam at head of canal, using 9.3 cubic yards concrete and 10.57 cubic yards top surfacing (granitoid). Put in new 3½-inch shafting in tunnels at locks for operating north and south gates; repaired north canal wall at Varble Chute; roofs of stable, scale house, and coal elevator, and replaced roof blown from lower lock engine house December 25, 1903; replaced old bridge log at Eighteenth Street Bridge and repaired paving to approach of bridge; relaid sidewalks about canal office, made new boxes for steam pipes at locks, repaired decking on upper and middle lock gates, and calked deck of the small towboat *Wave Rock.*

On November 20, 6.30 p. m., fire broke out in the south-middle lock engine house and destroyed the sheeting, purlins, corrugated iron roof, and all the doors and windows before the fire could be controlled. To repair the building it was necessary to remove the two end stone gables and a portion of the walls where the stones had been cracked by the intense heat. The stone and carpenter work was done by hired labor, and the renewal of the corrugated iron roof was done under an agreement with Messrs. J. H. Wagner & Sons, Louisville, Ky.

Repaired hog-chain braces and stiff legs on derrick boat, shutters for Boulé and Kentucky Chute dams, and bents and shutters for movable dam in Indiana Chute.

When repairs were needed to scows, barges, etc., they were placed in the canal dry dock, where the work of renewing old timbers and calking boats was done. The roadways about shops were kept in repair by spreading broken stone and screenings on them when needed.

### EXTRA LABOR.

A small force of laborers was employed during the year in keeping grounds clean about the shops, cutting grass from slopes and grounds about the canal, docking boats, and watching and caring for the floating plant; made screens for towboat *Col. G. L. Gillespie*, temporary quarters for men employed on locks during repairs to the damaged lock engine house; built wire fence, graded and sodded around new buildings, put in new sewer connection from canal office, removed loose rock from canal slopes and placed them behind the wall at Fourteenth street, dismantled old derrick boat, made pike poles for locks and boats, renumbered stations along canal wall, put up new window guards in blacksmith shop, cut down and burned old dead trees along north canal slope.

On September 13, 1903, the automatic gate was lowered at 9.15 a. m., and upon trying to raise the gate for passage of a vessel through the canal, it was found that the gate would not move. Two three-fourths inch chains with ratchet screws were fastened to the apex of the gate, one at each end, the valves for raising the gate closed, and the apex of the gate raised to the surface of the water, when it raised from the hollow quoin and moved forward the length of the upper folding leaf and sank to the bottom. On examination it was found that all the hold-down bolts and two adjoining hinges, hollow quoin and fifteen of the sixteen hinges at the apex of the gate were broken. The break in the hollow quoin, adjoining hinge, and hold-down bolts were evidently caused by a small piece of metal lodging between the base of the hollow quoin and the lower part of the gate. The marks made by the compressed metal on the hinge and hollow quoin were very plain. The metal acted as a fulcrum and the great leverage produced by the weight of the gate on being lowered ripped off the bolts. All of the fractures were apparently of the same age and of recent date. The hinges at the apex were wrenched off as the main leaf moved forward from the hollow quoins. The gate has been used since 1898 at all stages below 9 feet, canal gauge; at the time of the accident the gauge read 3.9.

To close the guard gates of the old locks where the automatic is located, it was necessary to build a dam across the canal, which was placed near Fourteenth street warehouse. The temporary dam used was the old one formerly used on the Indiana Chute. Work was commenced on the dam at 10 a. m., and completed at 10 p. m.; a few minutes later two sections of the dam slipped forward about 8 feet. Work was resumed the next morning, and by 11.30 a. m. the guard gates were closed, after which the temporary dam was removed, and by 1 p. m. the canal was reopened to navigation.

### MISCELLANEOUS, SUPPLIES, ETC.

Under this heading coal was purchased for locks and boats and unloaded into the coal elevator; also necessary supplies purchased for use in shops, on boats, locks, etc.

### NEW BLACKSMITH SHOP.

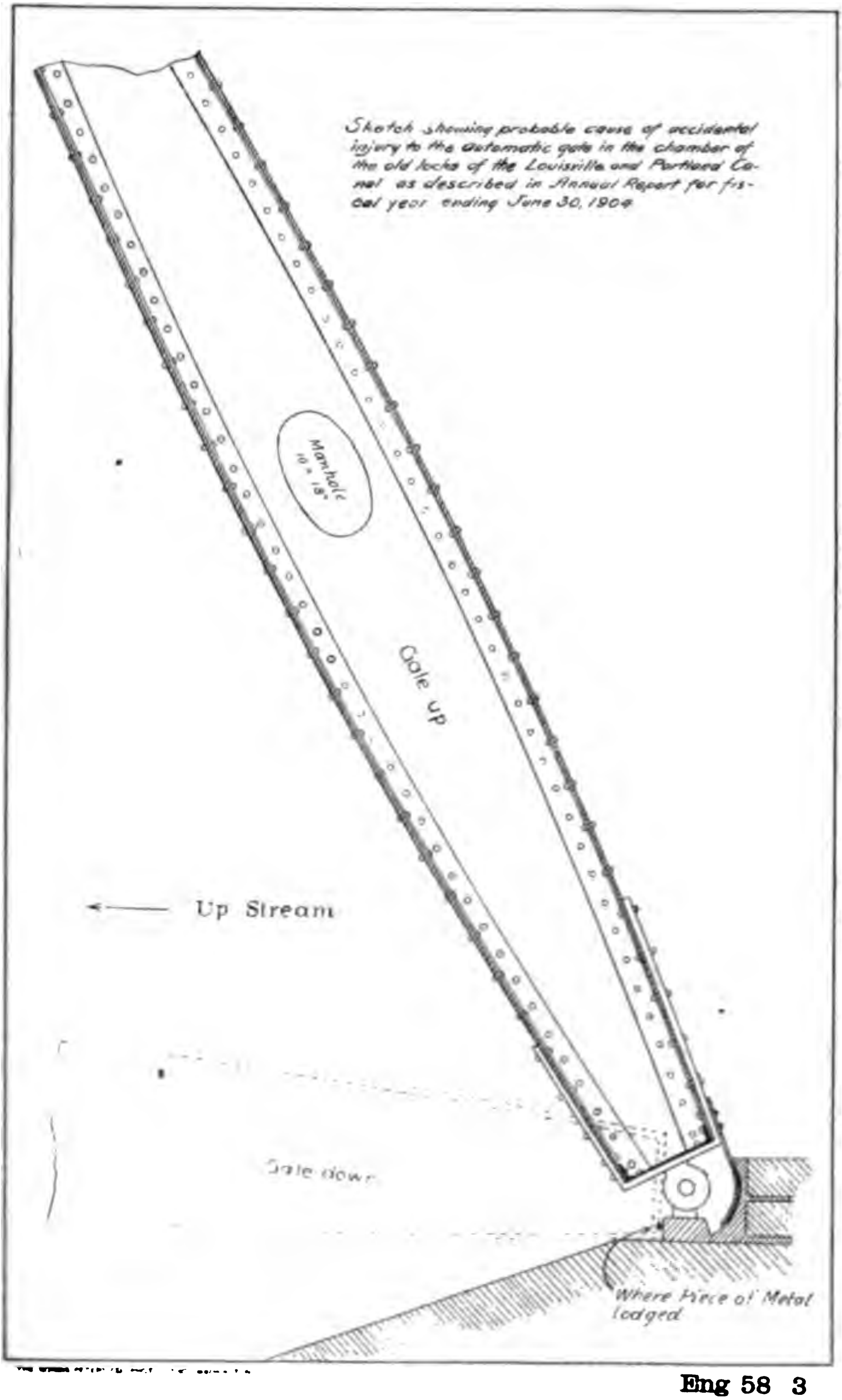
On July 23, 1903, a contract was entered into with Mr. Jacob Bornstein for furnishing all labor and material and, beginning with the base course of the building, to construct one brick blacksmith shop with stone trimmings, as required by the specifications and drawings dated April, 1903, for the sum of $8,629, the excavation for foundation and placing of concrete foundation to receive the base course to be done by the United States.

In June, of last year all of the excavating for foundation was completed ready to receive the concrete. From July 1 to 7, carpenters and laborers made forms, mixed and placed 103 cubic yards concrete in foundation, and graded and filled earth behind foundation. The contractor began delivering stone July 22, and on the 23d commenced setting the base course, and completed same on July 30. On November 18, 1903, the contract work was completed and the building accepted, it conforming to all the requirements of the specifications. New smokestacks were put up, steam and blast pipes fitted up for the forges, new racks and bins were made for tools, and the building occupied in December, 1903.

| | |
|---|---|
| Contract price | $8,629.00 |
| Labor | 374.60 |
| Material | 159.58 |

### SLOPE REVETMENT AT NINTH STREET.

The work done under this heading was for the protection of foundation of the canal branch office and adjoining slope at foot of Ninth street. During each period



Sketch showing probable cause of accidental injury to the automatic gate in the chamber of the old locks of the Louisville and Portland Canal as described in Annual Report for fiscal year ending June 30, 1904

of high water the slopes were exposed and undermined by the action of the waves. On September 23, three stonecutters began dressing stone, which had been gathered from the canal banks, for the revetment and steps. The revetment consists of rectangular limestone blocks laid in continuous uniform courses 5 inches to 8 inches in width, 10 inches to 18 inches in length, and about 10 inches in depth, laid on a 6-inch bed of gravel. The walk way laid on top of slope to the west line of Ninth street, distance about 27 feet, was made of natural cement concrete 6 inches thick and covered with 2 inches of Portland cement. The walk at the foot of the stone steps was made of natural cement concrete 12 inches thick.

The following are the quantities of work done:

| | | |
|---|---|---|
| Earth removed from slopes | cubic yards.. | 48 |
| Natural cement concrete used | do.... | 35.9 |
| Portland cement pavement laid | square yards.. | 12.3 |
| Broken stone used | cubic yards.. | 16.63 |
| Dry retaining wall built | do.... | 3.2 |
| Sand used | do.... | 18 |
| Gravel used | do.... | 40.53 |
| Pavement laid on slope | square yards.. | 130 |
| Portland cement used | barrels.. | 5 |
| Natural cement used | do.... | 27 |

*Cost.*

| | |
|---|---|
| Labor | $343.83 |
| Material | 117.73 |
| Total | 461.56 |

REMOVING DISRUPTED ROCK, CHANNEL BELOW LOCKS.

Drill scow *No. 1* began drilling September 2 and drill scow *No. 2* September 22, continuing to October 16, when, on account of a rise in the river, work was temporarily suspended. Resumed work of drilling October 21, continuing to October 31. Commenced to blast on October 2, continuing to October 31. The following are the quantities of work done:

| | |
|---|---|
| Number of drills operated daily | 7 to 14 |
| Number of holes drilled | 2,267 |
| Number of feet drilled | 7,414 |
| Number of blasts made | 59 |
| Number of holes blasted | 1,693 |
| Number of 12-foot exploders used | 1,709 |
| Pounds of 75 per cent dynamite used | 3,738 |
| Linear feet blasted | 6,489½ |
| Cubic yards rock disrupted | 2,636.9 |
| Number of large disrupted rock blasted | 16 |
| Cubic yards disrupted rock dredged, 3,570. scow measure, or place measure.. | 1,785 |

Dredge *Louisville No. 1* commenced November 2, continuing to December 24, dredging disrupted rock from channel, removing 1,670 cubic yards, scow measure; also cast 595 cubic yards on south shore to make a channel. Was laid up for repairs to machinery 8 days in November and 4 days in December.

Dredge *Louisville No. 2* worked, dredging disrupted rock from November 19 to 23 and December 12 and 14, removing 145 cubic yards, scow measure.

Dredge *Wabash* dredged disrupted rock from November 5 to 20, and December 2 to 10, removing 1,755 cubic yards, scow measure; was laid up for repairs to machinery November 21 and 22 and December 1; on November 23 was dragging for anchor and buoy.

*Expended.*

| | |
|---|---|
| Labor: | |
| Dredging | $1,689.08 |
| Drilling | 2,290.99 |
| Blasting | 305.08 |
| Repairs to steam drills | 164.64 |
| Coaling boats | 58.50 |
| | 4,508.29 |

[illegible]

[illegible]

[illegible] tons and [illegible] [illegible] the dry dock [illegible]

[illegible] CANAL.

[illegible] the canal 9.30 a. m. with a [illegible] canal station, [illegible] caused probably by the [illegible] north of the north channel line of the basin, and [illegible] The channel was practically closed to navigation 24 [illegible]

[illegible], steamer *Fulton*, while entering the canal with 2 coal boats and 1 [illegible] steamer *Fallie* with tow of 10 coal boats, all the property of the [illegible] Consolidated Coal and Coke Company, lost her tow opposite [illegible] on account of the steamer *Fallie* stopping and blocking up the [illegible] canal.

[illegible] came to a stand on the south shore she was allowed to drift toward the [illegible] and no apparent effort was made to save the tow until it got into the [illegible] control of the steamer. The owners saved the greater [illegible] and the boats were afterwards blown to pieces with dynamite.

[illegible] your obedient servant,

J. H. CASEY,
*Assistant Engineer.*

[illegible]
[illegible] Engineers.

## H H 3.

## [illegible] WABASH RIVER, INDIANA AND ILLINOIS.

[illegible] direct and scope of im- [illegible] will be [illegible] numerous [illegible]

[illegible]

[illegible]

second session. The work of preparing the maps of the survey has been in progress since September, 1903, and is now rapidly nearing completion. Of the whole number, 65 sheets, 51 have been entirely completed and 14 completed except the lettering.

The matters of general interest connected with the survey, such as distances and elevations of low-water surface at various places, are given in the accompanying tabular statement.

During the latter part of the fiscal year the application of the balance of funds not necessary for completing the maps of the survey, toward the removal of snags, etc., from the more obstructed portions of the river was authorized by the Chief of Engineers, and since June 20 the snag boat and a derrick boat pertaining to Green and Barren rivers, Kentucky, have been utilized in that work below Little Chain. The quantities of work accomplished by these boats to June 30, 1904, is summarized as follows:

| | |
|---|---|
| Snags removed from Little Chain | 108 |
| Snags removed below Little Chain | 128 |
| Stumps removed below Little Chain | 2 |
| Total | 238 |

The towboat *Col. G. L. Gillespie* was cared for at the Louisville and Portland Canal, where such ordinary repairs as were necessary to maintain the boat in good condition were made.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $15,866.77 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 11,565.57 |
| July 1, 1904, balance unexpended | 4,301.20 |
| July 1, 1904, outstanding liabilities | 491.68 |
| July 1, 1904, balance available | 3,809.52 |
| Amount (estimated) required for completion of existing project | 40,000.00 |

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APPROPRIATIONS.

| | |
|---|---|
| June 10, 1872 | $50,000 |
| March 3, 1873 | 50,000 |
| June 23, 1874 | 25,000 |
| March 3, 1875 | 40,000 |
| August 14, 1876 | 70,000 |
| June 18, 1878 | 50,000 |
| March 3, 1879 | 20,000 |
| June 14, 1880 | 25,000 |
| March 3, 1881 | 25,000 |
| August 2, 1882 | 40,000 |
| July 5, 1884 | 30,000 |
| August 5, 1886 | $60,000 |
| August 11, 1888 | 60,000 |
| September 19, 1890 | 60,000 |
| July 13, 1892 | 60,000 |
| August 18, 1894 | 15,000 |
| June 3, 1896 | 15,000 |
| March 3, 1899 | 15,000 |
| June 13, 1902 | 5,000 |
| Total | 715,000 |

### (B) IMPROVEMENT ABOVE VINCENNES.

No work was in progress on this section of the river during the year, the unexpended balance available being too small to permit of any advantageous operations.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $261.58 |
| July 1, 1904, balance unexpended | 261.58 |

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#### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1881 | $25,000 | August 18, 1894 | $5,000 |
| August 2, 1882 | 30,000 | June 3, 1896 | 6,000 |
| July 5, 1884 | 10,000 | March 3, 1899 | 4,000 |
| August 11, 1888 | 5,000 | | |
| September 19, 1890 | 5,500 | Total | 95,500 |
| July 13, 1892 | 5,000 | | |

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#### COMMERCIAL STATISTICS.

The only commercial statistics available for the year are given in the report for "Operating and care of lock and dam at Grand Rapids."

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*Table of distances, with elevation of low water above sea level, in Wabash River, from its mouth to Vincennes, Ind.*

| Location. | Miles from mouth of river. | Miles from Vincennes. | Elevation. |
|---|---|---|---|
| | | | *Feet.* |
| Mouth of Wabash River | 0.00 | 125.95 | 313.92 |
| Skidmore bar (foot) | 3.00 | 122.95 | 318.42 |
| Skidmore bar (head) | 3.70 | 122.25 | 319.10 |
| Creek (right bank) | 5.00 | 120.95 | 320.15 |
| Mackey's bar (foot) | 7.00 | 118.95 | 322.49 |
| Mackey's bar (head) | 7.50 | 118.45 | 323.11 |
| Bone bank (lower end) | 8.70 | 117.25 | 323.54 |
| Bone bank (upper end) | 8.90 | 117.05 | 323.61 |
| Raglan Island (lower end) | 11.70 | 114.25 | 326.67 |
| Raglan Island (upper end) | 12.10 | 113.85 | 327.07 |
| Schoolhouse | 12.20 | 113.75 | 327.23 |
| Little Wabash River | 14.50 | 111.45 | 328.70 |
| Ashworth's ferry | 21.50 | 104.45 | 333.51 |
| Old river bed | 21.60 | 104.35 | 333.54 |
| Little Chain Cut-off (lower end) | 22.65 | 103.30 | 333.82 |
| Old river bed | 23.00 | 102.95 | 334.34 |
| Little Chain (lower end) | 24.40 | 101.55 | 335.57 |
| Little Chain (upper end) | 24.80 | 101.15 | 336.81 |
| Little Chain Cut-off (upper end) | 25.30 | 100.65 | 336.98 |
| Big Creek (mouth of) | 27.70 | 98.25 | 337.64 |
| Marshall's ferry | 28.70 | 97.25 | 337.97 |
| Louisville and Nashville Railroad bridge | 30.00 | 95.95 | 338.38 |
| Grand Chain (foot) | 30.30 | 95.65 | 338.44 |
| Grand Chain (head) | 30.80 | 95.15 | 342.20 |
| Maunie | 33.00 | 92.95 | 342.31 |
| Maunie Ferry | 33.10 | 92.85 | 342.81 |
| Twin Sister Island, No. 2 (foot) | 35.10 | 90.85 | 342.67 |
| Twin Sister Island, No. 2 (head) | 35.70 | 90.25 | 343.01 |
| Twin Sister Island, No. 1 (foot) | 35.90 | 90.05 | 343.06 |
| Twin Sister Island, No. 1 (head) | 36.30 | 89.65 | 343.32 |
| Warwicks Ripple | 37.90 | 88.05 | 343.99 |
| Rush Creek | 38.00 | 87.95 | 344.06 |
| Mink Island (foot) | 38.30 | 87.65 | 344.22 |
| Mink Island (head) | 39.40 | 86.55 | 344.67 |
| Winkler's ferry | 39.60 | 86.35 | 344.69 |
| New Harmony Cut-off (foot) | 40.40 | 85.55 | 344.75 |
| Sugar Tree Ridge | 42.30 | 83.65 | 345.70 |
| Hodge's landing | 44.10 | 81.85 | 347.44 |
| Turkey Island (foot) | 45.80 | 80.15 | 348.11 |
| Turkey Island (head) | 47.60 | 78.35 | 349.02 |
| Fox River (mouth of) | 47.80 | 78.15 | 349.31 |
| New Harmony Cut-off (head) | 49.80 | 76.15 | 351.62 |
| New Harmony | 50.00 | 75.95 | 351.90 |

*Table of distances, with elevation of low water above sea level, in Wabash River, from its mouth to Vincennes, Ind.*—Continued.

| Location. | Miles from mouth of river. | Miles from Vincennes. | Elevation. |
|---|---|---|---|
| | | | *Feet.* |
| Steam Ferry | 50.30 | 75.65 | 351.96 |
| Gresham Creek | 50.40 | 75.55 | 352.01 |
| Juno Island (foot) | 51.30 | 74.65 | 352.72 |
| Juno Island (head) | 51.70 | 74.25 | 352.91 |
| Creek (left bank) | 52.70 | 73.25 | 353.63 |
| Baltimore Bend (lower end) | 53.30 | 72.65 | 354.01 |
| Black River | 53.70 | 72.25 | 354.28 |
| New Baltimore | 54.10 | 71.85 | 354.55 |
| Baltimore Bend (upper end) | 54.40 | 71.55 | 354.66 |
| Bald Point | 55.10 | 70.85 | 354.98 |
| Head of Little Fox River | 59.30 | 66.65 | 356.54 |
| French Creek | 60.50 | 65.45 | 357.42 |
| Webb's ferry (abandoned) | 61.40 | 64.55 | 357.58 |
| Illinois Central Railroad bridge | 61.50 | 64.45 | 357.60 |
| Grayville Ferry | 63.50 | 62.45 | 358.58 |
| Bonpas Creek | 63.57 | 62.41 | 358.60 |
| Kingdom Island (foot) | 64.80 | 61.15 | 358.71 |
| Kingdom Island (head) | 65.30 | 60.65 | 358.88 |
| Seagers Island (foot) | 70.30 | 55.65 | 360.39 |
| Seagers Island (head) | 70.50 | 55.45 | 361.15 |
| Peankishaw Bend (foot) | 71.40 | 54.55 | 361.87 |
| Peankishaw Bend (head) | 72.40 | 53.55 | 362.46 |
| Samar's bar | 74.40 | 51.55 | 363.58 |
| McCrearys Bluff (foot) | 77.60 | 48.35 | 366.10 |
| McCrearys Bluff (head) | 78.00 | 47.95 | 366.28 |
| Jimtown | 81.40 | 44.55 | 367.98 |
| Crawleyville | 82.60 | 43.35 | 368.82 |
| Cable Ferry | 86.80 | 39.15 | 369.44 |
| Rochester | 86.90 | 39.05 | 369.60 |
| Coffee Island (foot) | 87.20 | 38.75 | 370.00 |
| Coffee Island (head) | 87.70 | 38.25 | 371.67 |
| Schroat's mussel bar (foot) | 88.60 | 37.35 | 372.03 |
| Sugar Creek | 88.70 | 37.25 | 372.06 |
| Schroat's mussel bar (head) | 89.10 | 36.85 | 372.12 |
| Cable Ferry | 90.30 | 35.65 | 372.38 |
| Patoka Island (foot) | 90.90 | 35.05 | 372.40 |
| Greathouse Creek | 91.60 | 34.35 | 372.45 |
| Patoka Island (head) | 92.30 | 33.65 | 372.48 |
| Southern Railroad bridge | 92.58 | 33.37 | 372.50 |
| Patoka Creek | 92.60 | 33.35 | 372.60 |
| Mount Carmel | 92.70 | 33.25 | 372.66 |
| Mouth of White River | 93.70 | 32.25 | 373.08 |
| Ferry (Minor Bros.) | 93.80 | 32.15 | 373.16 |
| Grand Rapids Lock (below) | 95.18 | 30.79 | 374.334 |
| Grand Rapids Lock (above) | | | 386.13 |
| Hanging Rock | 97.50 | 28.45 | 386.14 |
| Crawfish Creek | 98.00 | 27.95 | 386.14 |
| Buchanan's ferry | 99.80 | 26.15 | 386.16 |
| Little Rock post-office | 103.30 | 22.65 | 386.28 |
| Catfish Bend (foot) | 105.50 | 20.45 | 386.77 |
| Catfish Bend (head) | 106.80 | 19.15 | 386.89 |
| River Duchee | 106.90 | 19.05 | 386.92 |
| Raccoon Creek | 109.10 | 16.85 | 388.08 |
| St. Francisville | 113.10 | 12.85 | 389.91 |
| Cleveland, Cincinnati, Chicago and St. Louis Railroad bridge | 116.40 | 9.55 | 391.51 |
| Nine Mile Island, or Pork Island (foot) | 117.25 | 8.70 | 392.56 |
| Nine Mile Island, or Pork Island (head) | 117.50 | 8.45 | 392.90 |
| Embarras River | 120.20 | 5.75 | 393.43 |
| Wagon bridge at Vincennes | 125.95 | 0.00 | 397.45 |
| Baltimore and Ohio Southwestern Railroad bridge at Vincennes | 126.38 | 0.43 | 397.79 |

## H H 4.

## OPERATING AND CARE OF LOCK AND DAM AT GRAND RAPIDS, WABASH RIVER.

The estimate and project for the operation and care of this lock and its appurtenant structures during the fiscal year ending June 30, 1904, contained the following items:

| | |
|---|---|
| Regular force | $1,200 |
| Repairs, supplies, etc | 2,175 |
| Total | 3,375 |

Expenditures during the year were for payment of the salary of the lock tender; minor repairs to the fences about the Government property; renewing several pieces of sheeting on the lower slope of the dam; removal of vegetation from the guide cribs and lock grounds; repairs to the roof of the lock tender's cottage and carpenter shop.

An unusually high stage of water occurred at the lock April 2, 1904, on which date the upper and lower gauge readings were 20.2 and 29.8, respectively. Considerable damage was done to the fences, grounds, and levee adjoining the lock.

*Summary of expenditures on account of operating and care of lock and dam at Grand Rapids, Wabash River, during the fiscal year 1904, showing general items and amount expended under each heading.*

| Item. | Amount. |
|---|---|
| Services | $991.81 |
| Supplies | 56.70 |
| Material | 48.60 |
| Miscellaneous | 109.47 |
| Total | 1,206.58 |

ALLOTMENTS.

| | | | |
|---|---|---|---|
| March 12, 1897 | $240.00 | July 10, 1901 | $5,184.34 |
| July 23, 1897 | 1,703.25 | July 29, 1902 | 1,311.38 |
| July 15, 1898 | 1,451.35 | July 20, 1903 | 326.89 |
| July 21, 1899 | 9,346.16 | | |
| July 17, 1900 | 7,752.52 | Total | 27,315.89 |

COMMERCIAL STATISTICS.

*Statements of traffic and commerce passing the lock at Grand Rapids, Wabash River, for the fiscal year ending June 30, 1904.*

TRAFFIC.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | [illegible] | [illegible] |
| Tow | [illegible] | [illegible] |
| Government | 2 | [illegible] |
| Barges | [illegible] | [illegible] |
| Small craft | [illegible] | [illegible] |
| Rafts | [illegible] | |
| Total | [illegible] | [illegible] |

Total number of lockages during past fiscal year, 365.

COMMERCE.

| Articles. | Quantity. |
|---|---|
| | Tons. |
| [illegible] | [illegible] |
| Lumber | [illegible] |
| Timber | [illegible] |
| Staves | [illegible] |
| Miscellaneous | [illegible] |
| Total | [illegible] |

Passengers, [illegible].

*Comparative statement of traffic and commerce at lock at Grand Rapids, Wabash River.*

| Fiscal year. | Traffic. | | | | | Commerce. |
|---|---|---|---|---|---|---|
| | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. | |
| | | | | | | *Tons.* |
| 1897 | 60 | 80 | 27 | 130 | 297 | 3,749 |
| 1898 | 46 | 76 | 31 | 199 | 352 | 2,374 |
| 1899 | 45 | 53 | 32 | 118 | 248 | 2,417 |
| 1900 | 49 | 53 | 36 | 100 | 238 | 6,419 |
| 1901 | 62 | 68 | 25 | 112 | 267 | 2,364 |
| 1902 | 48 | 45 | 14 | 171 | 278 | 2,448 |
| 1903 | 91 | 82 | 10 | 114 | 297 | 2,747 |
| 1904 | 139 | 53 | 38 | 249 | 479 | 4,370 |

## H H 5.

## IMPROVEMENT OF WHITE RIVER, INDIANA.

No operations under the existing project for the improvement of this river were in progress during the past fiscal year, the funds under the approved estimate being almost exhausted.

Full report of project, original condition, scope of improvement, etc., will be found in Annual Report of the Chief of Engineers, United States Army, for the fiscal year 1896, page 2244. Further information and references may be found on page 496 of this report.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $703.82 |
| July 1, 1904, balance unexpended | 703.82 |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1879 | $25,000 | August 11, 1888 | $5,000 |
| June 4, 1880 | 20,000 | July 13, 1892 | 5,000 |
| March 3, 1881 | 20,000 | August 18, 1894 | 5,000 |
| August 2, 1882 | 20,000 | June 3, 1896 | 2,500 |
| July 5, 1884 | 10,000 | | |
| August 5, 1886 | 7,500 | Total | 120,000 |

## H H 6.

## IMPROVEMENT OF GREEN RIVER ABOVE THE MOUTH OF BIG BARREN RIVER, KENTUCKY.

The river and harbor act of June 13, 1902, provided funds for the construction of the second lock (No. 6, Green River) proposed in the approved project of August 11, 1891, for the extension of slack-water navigation on this part of Green River to Mammoth Cave, Ky.

On account of the difficulty encountered in perfecting the title to the parcels of land required, the purchase of the sites for the lock and abutment was not effected until January 9, 1904. On May 10, 1904, a contract was entered into with the Hollerbach & May Contract Company, of Evansville, Ind., for the construction of the lock, dam, and abutment, and one office building. Under this contract excavating was commenced on June 14, 1904, and on June 30, 1904, the following work had been accomplished:

Office building about two-thirds completed.
Coffer-dam, 90 linear feet completed.
Excavation for lock chamber, 7,300 cubic yards.

In October and November, 1903, the snag boat *Wm. Preston Dixon* and the Green River dredge were engaged in clearing the banks of the pool of this lock, 8,421 trees being cut or deadened. A lock-tender's cottage is being constructed by hired labor; this building on June 30, 1904, was about one-third completed.

Further information and references will be found on page 497 of this report.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $180,613.60 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 3,097.24 |
| July 1, 1904, balance unexpended | 177,516.36 |
| July 1, 1904, outstanding liabilities | 1,882.71 |
| July 1, 1904, balance available | 175,633.65 |
| July 1, 1904, amount covered by uncompleted contracts | 129,746.17 |

APPROPRIATIONS.

| | |
|---|---|
| July 13, 1892 | $50,000.00 |
| August 18, 1894 | 25,000.00 |
| June 3, 1896 | 20,000.00 |
| March 3, 1899 | 85,673.20 |
| June 3, 1902 | 180,000.00 |
| Total | 360,673.20 |

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: The Hollerbach & May Contract Company.
Date of contract: May 10, 1904.
For building Lock and Dam No. 6, Green River, Kentucky, at prices as follows:

35,615 cubic yards excavation, at 50 cents per cubic yard.
16,900 cubic yards back fill, at 20 cents per cubic yard.
31,000 linear feet foundation piles, at 25 cents per linear foot.
6,600 linear feet sheet piles, 12 inches thick, at 50 cents per linear foot.
17,260 linear feet sheet piles, 9 inches thick, at 40 cents per linear foot.
107,169 feet B. M. foundation and drain timber, at $30 per thousand feet B. M.,
4 miter and coffer sills, at $100 for the lot.
10,360 cubic yards concrete, at $7 per cubic yard.
1 office building, complete, for $1,250.
760 cubic yards broken stone for drain, at $1.70 per cubic yard.
16 linear feet sewer pipe drain, at 50 cents per linear foot.
3,964 cubic yards broken stone filling, under dam and apron, pieces not less than one-half cubic foot, at $1.70 per cubic yard.
3,520 cubic yards backing, above dam, dredged material, at 30 cents per cubic yard.
1,304 cubic yards broken stone filling, below dam, pieces not less than one-half cubic yard, at $1.70 per cubic yard.
552 square yards stone paving, in lock chamber, at $4 per square yard.

The quantities are approximate only.
Contract approved by the Chief of Engineers, United States Army, June 3, 1904.
Work under contract commenced June 14, 1904.
Contract expires January 1, 1906.

Commercial statistics are given in the report for "Operating and care of locks and dams on Green and Barren rivers, Kentucky."

## H H 7.

## OPERATING AND CARE OF LOCKS AND DAMS ON GREEN AND BARREN RIVERS, KENTUCKY.

The project and estimate for the fiscal year ending June 30, 1904, approved July 20, 1903, provided as follows:

It is proposed to operate the several locks and to make such repairs to them—the dams, guide cribs, dwellings, storehouses, and other Government property at the several locks—as are necessary to maintain the system in good navigable condition, and keep the other Government property in serviceable repair; in connection with which work the United States snagging and dredging outfits, consisting of a snag boat, dredge, small towboat, scows, barges, and derrick boats, will be operated to keep the pools, lock chambers, and entrances thereto free from deposits of mud, leaves, snags, and other obstructions brought into them by the varying stages of water. The system now comprises six locks and dams, viz, Nos. 1, 2, 3, 4, and 5, Green River, and No. 1, Barren River, together with the contiguous land and buildings owned by the Government.

The estimate for the fiscal year 1904 is summarized as follows:

| | |
|---|---|
| Regular force | $39,375.00 |
| Repairs | 73,758.17 |
| Miscellaneous, supplies and contingencies | 10,000.00 |
| Total | 123,133.17 |

Under this project and the estimate submitted therewith, the operations during the fiscal year, in addition to the usual work of passing traffic and minor current repairs incident to care and preservation, were briefly summarized, as follows:

At Lock No. 1, Green River, the work of placing a concrete top on the dam was commenced by the contractors, Hollerbach & May, September 1, 1903, and was about half completed when work was suspended on November 5, 1903, on account of high water. This work is to be resumed as soon as the stage of water permits. About 440 linear feet of new fence was built; a small quantity of stone was placed in the lower shore crib; other minor repairs were made.

At Lock No. 2, Green River, the frame cottage and the brick office and warehouse were begun in May, the work being done by hired labor. The foundations of both buildings are completed and the framing of the cottage is well advanced. The small bridge across the mill race on the reservation was rebuilt. Other minor repairs were made. In February, 1904, during high water, about 80 feet of the apron of the dam was washed out. This is to be replaced as soon as the stage of water permits.

At Lock No. 3, Green River, the work of removing 250 linear feet of the old lower shore crib, begun last fiscal year, was completed and the new crib constructed, the total cost of the work being $7,764.89. During the months of July to October the portion of the dam which had been torn away during the previous winter was repaired at a cost of $5,552.91. Considerable dredging was required in the lock chamber and approaches, and other minor work was done. Practically all the materials required for the proposed brick warehouse at this lock have been purchased and stored near site for building. The actual construction will be begun in July, 1904.

At Lock No. 4, Green River, during June, 1904, the lock was pumped out for the purpose of repairing the lower miter sill, which had been forced up several inches at the toe, causing a serious leak at that point. The work on the sill required the lock to be closed to navigation from 7 a. m., June 21, to 3 p. m., June 25, 1904. One thousand one hundred and ninety-two feet of new fencing was constructed; the track, from lock wall to warehouse, was extended 438 feet to the lumber house; and the washout, made by high water, back of the land wall, was filled with earth and broken stone. Other minor repairs were made.

At lock No. 5, Green River, the bank below the lock wall was graded and 608 square yards of riprap bank protection was laid. Other minor repairs were made.

At Lock No. 1, Barren River, a new wooden warehouse was constructed at a total cost of $669.66. The old lower river crib was removed, but was not replaced. A few repairs to the apron of the dam and other minor repairs were made.

The floating plant was employed in keeping the pools, entrances to the locks, and the lock chambers free from snags and deposits, and also in assisting in the more important pieces of repair work. On June 20, 1904, the *Dixon* and one of the derrick boats were sent to the Wabash River, Indiana and Illinois, to remove snags, etc.

During the winter season the machinery and appliances on all of the boats, as well as their hulls, cabins, etc., were repaired and made ready for the working season of 1904. The Green River quarter boat, which was sunk on the Wabash River in August, 1903, had an entire new bottom put on the hull, the cabin straightened, shores and braces put in, and such other repairs as were necessary to put it in good condition were made.

The details of the year's operations are set forth in the report of Mr. W. S. Overstreet, master, to which attention is respectfully invited.

*Summary of expenditures on account of "Operating and care of Green and Barren rivers, Kentucky," fiscal year 1904, showing general items and amount expended under each heading.*

| Item. | Amount. |
|---|---|
| Services | $36,442.86 |
| Supplies | 2,458.41 |
| Materials | 20,503.62 |
| Miscellaneous | 655.17 |
| Total | 60,060.06 |

### COLLECTIONS.

| | | |
|---|---|---|
| 1903. | | |
| July 6. | Jett & Turner, for water power, Lock No. 2, Green River, Kentucky | $50.00 |
| July 13. | Wm. Boulton, for water power, Lock No. 1, Barren River, Kentucky | 75.00 |
| 1904. | | |
| Jan. 9. | Jett & Turner, for water power, Lock No. 2, Green River, Kentucky | 50.00 |
| Jan. 18. | Craig Brothers, for water power, Lock No. 3, Green River, Kentucky | 75.00 |
| Jan. 28. | R. C. Bryant, for water power, Lock No. 2, Green River, Kentucky | 150.00 |
| | Total | 400.00 |

All of these collections were deposited to the credit of the Treasurer of the United States.

### APPROPRIATIONS AND ALLOTMENTS.

| | | | |
|---|---|---|---|
| August 11, 1888 | $135,000.00 | September 2, 1896 | $77,684.35 |
| January 4, 1889 | 167,112.00 | July 23, 1897 | 57,459.61 |
| July 20, 1889 | 139,110.00 | July 15, 1898 | 70,219.75 |
| July 17, 1890 | 53,783.47 | July 22, 1899 | 65,007.65 |
| July 16, 1891 | 77,807.26 | July 17, 1900 | 69,349.64 |
| July 15, 1892 | 46,264.26 | July 10, 1901 | 43,236.82 |
| July 15, 1893 | 49,730.88 | July 30, 1902 | 105,629.33 |
| July 13, 1894 | 25,927.23 | July 20, 1903 | 34,720.47 |
| January 26, 1895 | 6,000.00 | | |
| July 20, 1896 | 51,080.31 | Total | 1,275,123.03 |

### ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: Hollerbach & May.

Date of contract: July 23, 1902.

For repairing Dam No. 1, Green River, Kentucky, at prices as follows:

5,953 cubic yards concrete, at $5.10 per cubic yard.

3,970 cubic yards earth excavation, at 55 cents per cubic yard.

4,693 cubic yards crib excavation, at 80 cents per cubic yard.

The quantities are approximate only.

Contract approved by the Acting Chief of Engineers, United States Army, August 19, 1902.

Work under contract commenced September 1, 1903.

Original date of expiration, September 1, 1903.

Time limit waived to December 31, 1903, with consent of surety, dated September 8, 1903.

Time limit waived to November 1, 1904, with consent of surety, dated December 4, 1903.

### COMMERCIAL STATISTICS.

*Statement of traffic passing the locks on Green and Barren rivers from July 1, 1903, to June 30, 1904.*

LOCK NO. 1, GREEN RIVER.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | 367 | 70,911 |
| Tow | 989 | 56,845 |
| Government | 22 | 1,274 |
| Barges | 2,127 | 686,061 |
| Small craft | 185 | 3,928 |
| Rafts | 338 | .......... |
| Total | 4,028 | 819,019 |

Total number of lockages during past fiscal year, 3,925.

*Statement of traffic passing the locks on Green and Barren rivers from July 1, 1903, to June 30, 1904*—Continued.

### LOCK NO. 2, GREEN RIVER.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | 390 | 73,040 |
| Tow | 684 | 41,070 |
| Government | 31 | 3,909 |
| Barges | 1,884 | 562,705 |
| Small craft | 207 | 2,563 |
| Rafts | 227 | ............ |
| Total | 2,923 | 683,287 |

Total number of lockages during past fiscal year, 3,424.

### LOCK NO. 3, GREEN RIVER.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | 374 | 70,142 |
| Tow | 352 | 23,769 |
| Government | 101 | 15,799 |
| Barges | 893 | 428,549 |
| Small craft | 146 | 945 |
| Rafts | 191 | ............ |
| Total | 2,057 | 539,204 |

Total number of lockages during past fiscal year, 2,394.

### LOCK NO. 4, GREEN RIVER.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | 342 | 66,218 |
| Tow | 468 | 29,998 |
| Government | 100 | 15,411 |
| Barges | 817 | 325,275 |
| Small craft | 86 | 1,474 |
| Rafts | 68 | ............ |
| Total | 1,881 | 438,376 |

Total number of lockages during past fiscal year, 2,003.

### LOCK NO. 5, GREEN RIVER.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | 2 | 8 |
| Tow | 485 | 20,439 |
| Government | 33 | 4,922 |
| Barges | 646 | 191,810 |
| Small craft | 207 | 2,251 |
| Rafts | 49 | ............ |
| Total | 1,422 | 219,430 |

Total number of lockages during past fiscal year, 1,284.

### LOCK NO. 1, BARREN RIVER.

| Kind of boat. | Number. | Tonnage. |
|---|---|---|
| Passenger | 339 | 62,878 |
| Tow | 419 | 18,464 |
| Government | 61 | 7,405 |
| Barges | 486 | 108,296 |
| Small craft | 53 | 356 |
| Rafts | 5 | ............ |
| Total | 1,363 | 197,399 |

Total number of lockages during past fiscal year, 1,265.

*Statement of commerce passing the locks on Green and Barren rivers from July 1, 1903, to June 30, 1904.*

LOCK NO. 1, GREEN RIVER.

| Articles. | Quantity. | Articles. | Quantity. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Coal | 13,588 | Straw | 47 |
| Corn | 1,472 | Cattle | 797 |
| Wheat | 476 | Swine and sheep | 1,145 |
| Salt | 790 | Horses and mules | 85 |
| Oil | 216 | Lumber | 23,178 |
| Whisky | 24 | Timber | 169,195 |
| Flour | 978 | Staves | 3,063 |
| Sugar | 743 | Shingles | 82 |
| Molasses | 64 | Ties, railroad | 106,714 |
| Sorghum | 54 | Manufactured iron | 43 |
| Cement | 1,671 | Miscellaneous | 14,645 |
| Tobacco | 825 | | |
| Hides | 1 | Total | 329,896 |

Number of passengers, 9,445.

LOCK NO. 2, GREEN RIVER.

| | | | |
|---|---|---|---|
| Coal | 921 | Swine and sheep | 583 |
| Corn | 1,261 | Horses and mules | 41 |
| Wheat | 228 | Lumber | 11,820 |
| Salt | 788 | Timber | 96,574 |
| Oil | 144 | Staves | 2,417 |
| Whisky | 24 | Shingles | 318 |
| Flour | 726 | Ties, railroad | 122,656 |
| Sugar | 593 | Hoop poles | 567 |
| Molasses | 39 | Manufactured iron | 15 |
| Cement | 165 | Miscellaneous | 12,812 |
| Tobacco | 758 | | |
| Straw | 181 | Total | 253,979 |
| Cattle | 814 | | |

Number of passengers, 7,381.

LOCK NO. 3, GREEN RIVER.

| | | | |
|---|---|---|---|
| Coal | 6,862 | Cattle | 839 |
| Corn | 915 | Swine and sheep | 438 |
| Wheat | 180 | Horses and mules | 107 |
| Salt | 489 | Lumber | 2,298 |
| Oil | 22 | Timber | 63,415 |
| Whisky | 8 | Staves | 1,031 |
| Flour | 293 | Shingles | 48 |
| Sugar | 344 | Ties, railroad | 94,597 |
| Molasses | 29 | Hoop poles | 809 |
| Sorghum | 14 | Manufactured iron | 17 |
| Cement | 60 | Miscellaneous | 7,455 |
| Tobacco | 381 | | |
| Straw | 51 | Total | 179,702 |

Number of passengers, 5,901.

LOCK NO. 4, GREEN RIVER.

| | | | |
|---|---|---|---|
| Coal | 13,676 | Cattle | 64 |
| Corn | 722 | Swine and sheep | 156 |
| Wheat | 144 | Horses and mules | 92 |
| Salt | 242 | Lumber | 998 |
| Oil | 68 | Timber | 19,857 |
| Whisky | 6 | Staves | 92 |
| Flour | 289 | Shingles | 21 |
| Sugar | 208 | Ties, railroad | 67,716 |
| Molasses | 13 | Hoop poles | 208 |
| Sorghum | 4 | Manufactured iron | 19 |
| Cement | 34 | Miscellaneous | 3,431 |
| Tobacco | 208 | | |
| Straw | 26 | Total | 108,294 |

Number of passengers, 1,376.

*Statement of commerce passing the locks on Green and Barren rivers from July 1, 1903, to June 30, 1904*—Continued.

## LOCK NO. 5, GREEN RIVER.

| Articles. | Quantity. | Articles. | Quantity. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Coal | 456 | Lumber | 398 |
| Corn | 17 | Timber | 15,038 |
| Wheat | 1 | Staves | 865 |
| Salt | 78 | Shingles | 2 |
| Oil | 29 | Ties, railroad | 49,481 |
| Whisky | 1 | Hoop poles | 12 |
| Flour | 109 | Manufactured iron | 41 |
| Sugar | 18 | Miscellaneous | 861 |
| Cement | 57 | | |
| Asphalt | 1,843 | Total | 69,226 |
| Straw | 24 | | |

Number of passengers, 287.

## LOCK NO. 1, BARREN RIVER.

| | | | |
|---|---|---|---|
| Coal | 13,873 | Straw | 41 |
| Corn | 729 | Cattle | 32 |
| Wheat | 144 | Swine and sheep | 65 |
| Salt | 456 | Horses and mules | 86 |
| Oil | 64 | Lumber | 1,114 |
| Whisky | 6 | Timber | 3,371 |
| Flour | 371 | Staves | 39 |
| Sugar | 200 | Shingles | 20 |
| Molasses | 13 | Ties, railroad | 7,658 |
| Sorghum | 8 | Manufactured iron | 47 |
| Cement | 78 | Miscellaneous | 4,396 |
| Tobacco | 162 | | |
| Hides | 9 | Total | 32,982 |

Number of passengers, 5,814.

*Comparative statement of traffic and commerce, Green and Barren rivers, Kentucky.*

## TRAFFIC.

| Fiscal year. | Lock No. 1, Green River. | | | | | Lock No. 2, Green River. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. |
| 1889 | 284 | 129 | 350 | 138 | 901 | 272 | 107 | 300 | 15 | 694 |
| 1890 | 854 | 386 | 1,079 | 111 | 2,430 | 776 | 286 | 768 | 12 | 1,842 |
| 1891 | 875 | 456 | 1,082 | 152 | 2,565 | 768 | 358 | 721 | 24 | 1,871 |
| 1892 | 787 | 449 | 898 | 184 | 2,318 | 634 | 272 | 785 | 6 | 1,697 |
| 1893 | 823 | 506 | 914 | 161 | 2,404 | 304 | 379 | 745 | 9 | 1,437 |
| 1894 | 832 | 437 | 602 | 176 | 2,047 | 477 | 333 | 413 | 9 | 1,232 |
| 1895 | 789 | 606 | 240 | 264 | 1,899 | 652 | 494 | 152 | 46 | 1,344 |
| 1896 | 1,143 | 553 | 620 | 162 | 2,478 | 702 | 469 | 440 | 168 | 1,779 |
| 1897 | 919 | 539 | 226 | 157 | 1,841 | 935 | 632 | 239 | 252 | 2,058 |
| 1898 | 1,122 | 882 | 340 | 200 | 2,544 | 1,037 | 847 | 260 | 182 | 2,326 |
| 1899 | 1,174 | 803 | 570 | 169 | 2,716 | 948 | 819 | 469 | 184 | 2,420 |
| 1900 | 1,088 | 1,239 | 481 | 132 | 2,940 | 946 | 1,087 | 521 | 156 | 2,710 |
| 1901 | 1,360 | 1,765 | 592 | 139 | 3,856 | 1,220 | 1,443 | 302 | 137 | 3,102 |
| 1902 | 992 | 1,113 | 530 | 137 | 2,772 | 820 | 927 | 364 | 255 | 2,366 |
| 1903 | 1,077 | 1,403 | 608 | 158 | 3,216 | 982 | 1,044 | 408 | 229 | 2,663 |
| 1904 | 1,378 | 2,127 | 338 | 185 | 4,028 | 1,105 | 1,384 | 227 | 207 | 2,923 |

*Comparative statement of traffic and commerce, Green and Barren rivers, Kentucky*—Con.

TRAFFIC—Continued.

| Fiscal year. | Lock No. 3, Green River. | | | | | Lock No. 4, Green River. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. |
| 1889 | ........ | ........ | 200 | ........ | 200 | 115 | 49 | 41 | 51 | 256 |
| 1890 | ........ | ........ | ........ | ........ | ........ | 126 | 55 | 36 | 123 | 340 |
| 1891 | 225 | 57 | 372 | 101 | 755 | 399 | 141 | 87 | 134 | 761 |
| 1892 | 492 | 305 | 426 | 212 | 1,435 | 619 | 276 | 208 | 129 | 1,232 |
| 1893 | 509 | 269 | 560 | 249 | 1,587 | 553 | 333 | 292 | 144 | 1,332 |
| 1894 | 611 | 469 | 304 | 227 | 1,611 | 592 | 391 | 117 | 115 | 1,215 |
| 1895 | 711 | 456 | 123 | 212 | 1,502 | 866 | 471 | 54 | 116 | 1,507 |
| 1896 | 880 | 486 | 234 | 238 | 1,838 | 1,307 | 676 | 112 | 102 | 2,197 |
| 1897 | 867 | 522 | 103 | 144 | 1,636 | 1,249 | 820 | 53 | 53 | 2,175 |
| 1898 | 835 | 613 | 133 | 167 | 1,748 | 1,192 | 884 | 39 | 176 | 2,291 |
| 1899 | 712 | 532 | 315 | 220 | 1,779 | 1,073 | 828 | 159 | 141 | 2,201 |
| 1900 | 750 | 695 | 288 | 158 | 1,891 | 1,099 | 929 | 122 | 138 | 2,288 |
| 1901 | 1,019 | 1,081 | 202 | 108 | 2,410 | 1,347 | 1,017 | 75 | 141 | 2,580 |
| 1902 | 757 | 780 | 293 | 223 | 2,053 | 1,012 | 814 | 102 | 229 | 2,157 |
| 1903 | 717 | 707 | 278 | 233 | 1,935 | 1,049 | 763 | 111 | 249 | 2,172 |
| 1904 | 827 | 893 | 191 | 146 | 2,057 | 910 | 817 | 68 | 86 | 1,881 |

| Fiscal year. | Lock No. 5, Green River. | | | | | Lock No. 1, Barren River. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. |
| 1889 | ........ | ........ | ........ | ........ | ........ | 112 | 57 | 10 | 85 | 264 |
| 1890 | ........ | ........ | ........ | ........ | ........ | 23 | 20 | 8 | 13 | 64 |
| 1891 | ........ | ........ | ........ | ........ | ........ | 342 | 177 | 7 | 3 | 529 |
| 1892 | ........ | ........ | ........ | ........ | ........ | 555 | 180 | 36 | 30 | 801 |
| 1893 | ........ | ........ | ........ | ........ | ........ | 518 | 290 | 32 | 14 | 854 |
| 1894 | ........ | ........ | ........ | ........ | ........ | 534 | 347 | 22 | 42 | 945 |
| 1895 | ........ | ........ | ........ | ........ | ........ | 618 | 335 | 32 | 56 | 1,041 |
| 1896 | ........ | ........ | ........ | ........ | ........ | 859 | 351 | 15 | 36 | 1,261 |
| 1997 | ........ | ........ | ........ | ........ | ........ | 842 | 451 | 10 | 104 | 1,407 |
| 1898 | ........ | ........ | ........ | ........ | ........ | 789 | 563 | 1 | 86 | 1,429 |
| 1899 | ........ | ........ | ........ | ........ | ........ | 826 | 528 | 3 | 119 | 1,476 |
| 1900 | 238 | 255 | 47 | 76 | 616 | 797 | 462 | 4 | 103 | 1,366 |
| 1901 | 376 | 383 | 29 | 217 | 1,005 | 992 | 497 | 20 | 93 | 1,602 |
| 1902 | 391 | 388 | 53 | 182 | 1,014 | 859 | 499 | 10 | 108 | 1,476 |
| 1903 | 393 | 465 | 59 | 208 | 1,125 | 1,066 | 653 | 13 | 120 | 1,852 |
| 1904 | 520 | 646 | 49 | 207 | 1,422 | 819 | 486 | 5 | 53 | 1,363 |

COMMERCE.

| Fiscal year. | Green River. | | | | | Barren River—Lock No. 1. |
|---|---|---|---|---|---|---|
| | Lock No. 1. | Lock No. 2. | Lock No. 3. | Lock No. 4. | Lock No. 5. | |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1889 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1890 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1891 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1892 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1893 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1894 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1895 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1896 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1897 | ............ | ............ | ............ | ............ | ............ | ............ |
| 1898 | 193,475 | 161,841 | 109,107 | 84,761 | ............ | 28,483 |
| 1899 | 257,104 | 184,895 | 84,139 | 43,973 | ............ | 43,504 |
| 1900 | 378,684 | 288,948 | 172,016 | 139,530 | 47,098 | 33,355 |
| 1901 | 452,522 | 285,744 | 183,512 | 117,054 | 57,058 | 46,445 |
| 1902 | 385,546 | 242,722 | 153,087 | 110,468 | 47,940 | 30,616 |
| 1903 | 457,386 | 269,142 | 165,746 | 106,119 | 59,525 | 48,738 |
| 1904 | 329,896 | 253,979 | 179,702 | 108,294 | 69,226 | 32,962 |

*List of boats plying on Green, Barren, and Rough rivers, Kentucky, during the fiscal year ending June 30, 1904.*

| Name of boat. | Character. | Tonnage. |
|---|---|---|
| Wm. Preston Dixon | U. S. snag boat | 200 |
| Emerald | U. S. towboat | 15 |
| Park City | Passenger boat | 197 |
| Crescent City | do | 194 |
| J. C. Kerr | do | 125 |
| Liberty | do | 68 |
| Little Ben | do | 33 |
| Percy L | do | 13 |
| Kalista | do | 9 |
| Water Lilly | do | 9 |
| St. Clair | do | 6 |
| Peter Hontz | Tow | 100 |
| Little Clyde | do | 99 |
| Nellie Willett | do | 98 |
| Mary Lacy | do | 98 |
| J. M. Bowell | do | 94 |
| Frances | do | 93 |
| D. A. Nisbet | do | 85 |
| Neptune | do | 80 |
| Mary Stewart | do | 77 |
| Kenois | do | 69 |
| Isabella | do | 66 |
| Old Reliable | do | 64 |
| Racket | do | 60 |
| Allie | do | 53 |
| Emma | do | 58 |
| Thomas Parker | do | 57 |
| Peerless | do | 50 |
| Sunbeam | do | 41 |
| Alma | do | 41 |
| J. B. Horton | do | 36 |
| Royal Prince | do | 29 |
| Lotus | do | 28 |
| R. P. Hobson | do | 22 |
| White Dove | do | 15 |
| Laura | do | 13 |
| Mystic | do | 9 |
| Rose | do | 9 |
| Lena Archer | do | 8 |
| Levi | do | 8 |
| Jessie | do | 7 |
| R. Nash | do | 6 |
| Dorothy | do | 5 |
| Agnes | do | 4 |
| Leonette | do | 3 |
| Alice L. Barr | Tug | 50 |
| J. B. A | do | 50 |
| Louise | do | 41 |
| Edgar | do | 37 |
| Ingleside | do | 36 |
| Lydia Wheeler | do | 31 |
| Alfred Hennen | do | 31 |
| Three Brothers | Freight | 53 |
| Ramona | Pleasure | 12 |
| Nannette | do | 9 |
| "O" | do | 8 |
| Stella | do | 4 |
| Sweetheart | do | 3 |
| Wawa | do | 2 |
| Tad | do | 2 |
| Maud | do | 2 |
| Idlewild | do | 1 |
| Little Dago | do | 1 |
| Mildred | do | 1 |

## STATE AND NATIONAL LAWS PERTAINING TO GREEN, BARREN, AND ROUGH RIVERS, KENTUCKY.

### AN ACT to incorporate the Green and Barren River Navigation Company.

Whereas the Green and Barren river line of navigation has always been a charge upon the State, and is now largely in debt and without prospect of any better condition; and whereas it is of great importance to the country to keep said line in working order, and at the same time avoid any public expense, if possible, and believing that object can be accomplished by letting it to an incorporated company: Therefore, *Be it enacted by the general assembly of the Commonwealth of Kentucky*, That J. A. Robinson, J. V. Sprowle, W. S. Vanmeter, C. J. Vanmeter, E. B. Seeley, H. C. Murrell, William Brown, D. C. Turner, C. J. Smallhouse, and their associates and successors, be, and they are hereby, created a body corporate with the name and style of the Green and Barren River Navigation Company, and shall have perpetual succession during the term of thirty years, and in that name may sue and be sued, make contracts, and transact all their legitimate business as a corporation; may use and change their common seal and make suitable by-laws for the regulation of the affairs of the company, and to regulate their elections to fill offices, vacancies, and in all things not inconsistent with the laws of the land.

(2) That the said Green and Barren river line of navigation and their tributaries, together with the grounds, houses, waterworks, rents, profits, tools, machinery, implements, and appurtenances, and all the franchises thereunto belonging or appertaining, be, and the same are hereby, loaned and conveyed unto the corporators named in the first section of this act, and to their associates, successors, executors, heirs, and assigns, for and during the term of thirty years from and after the time they get possession thereof; and it shall be the duty of the governor of this Commonwealth to cause possession thereof to be delivered unto them as soon after the passage of this act as they or any of them who may choose to accept may give notice of readiness to receive it upon their complying with all the conditions precedent herein provided.

(3) The business of the company may be to use and suffer to be used said line of navigation for all purposes of navigation, and also the water power, property, rights, appurtenances, and all the franchises thereunto belonging, as they may direct, not inconsistent with the purposes of said line as expressed by law; and as an auxiliary to said business and to facilitate commerce and trade, and to develop the resources of wealth along said line, it may also be their business to open and work coal mines and other mines and to deal in the products thereof, as also in the products of the country and other things, as well as in the work of machinery and navigation on said line. They may also lease, buy, sell, hold, and otherwise acquire and dispose of any real and personal estate, by any manner not prohibited by law, the same as a natural person, and may do all necessary or advantageous acts in the same way in the transaction of their business, not inconsistent with the constitution of this State or of the United States.

(4) It shall be the business and duty of said company to use due diligence in keeping up said line of navigation in good repair, and to return it and all its appurtenances at the expiration of the lease in good condition as at present, or unless prevented from so doing by unavoidable causes, and to hold the State harmless in the premises, and to pass and permit all boats, crafts, and other things to navigate said rivers, according to certain specified rates herein prescribed as tolls, which shall inure to said company.

(5) (Organization, &c., of company) * * * and a prior lien is hereby retained by the Commonwealth against all the property, rights, and franchises of said company, as security to said Commonwealth for the faithful performance of all the duties herein imposed upon said company; and no individual of said company shall be bound for said company beyond the interest he may have therein.

(6) All tolls shall inure to the company, and the rate of toll on passenger and freight steamboats, and other boats carrying freight other than coal or stone, shall be regulated by their full hull or deck tonnage, according to the custom-house rules as to the management of tonnage: *Provided*, That the rate of toll for such boats passing such locks shall not exceed per ton, measured as aforesaid, fifty cents at the first lower lock, and thirty cents at the second, and twenty cents at the third, and ten cents each at the two other upper locks, and the same for returning; and for each passenger, and for all other boats, barges, skiffs, and other water crafts, loaded and empty, including rafts and other things passing said rivers, they may establish tolls from time to time not exceeding the present rates established by the board of internal improvement as applicable to the Kentucky, Green, and Barren river lines of navigation at this time.

(7) (Transfers of interest, &c.)

(8) (Liabilities for damages.)

(9) (Steamboats, rafts, &c., shall obey company's rules.)

(10) (Penalty for willful injury of works.)

(11) It shall be the duty of the company, or such of them as may choose to accept the provisions of this charter, together with their associates whom they may choose to associate with them, to execute their bond to the Commonwealth of Kentucky, with security, the solvency of which to be approved by the governor of said Commonwealth, and be attested by him under the seal of his office, which bond shall be in duplicate, one copy to be retained by the State and the other by the company. The

conditions of the bond shall be as follows: "In consideration of the undisturbed possession of the Green and Barren river line of navigation and its tributaries, together with its grounds, houses, water powers, rents, profits, tools, machinery, implements, appurtenances, and all its franchises thereunto belonging or appertaining, now to be delivered to us, the undersigned, to hold for thirty years, under an act of the legislature incorporating the Green and Barren River Navigation Company, we accept the same, and as a company aforesaid are bound hereby in the penal sum of five hundred thousand dollars to perform the duties and obligations imposed by said act of the legislature, and to return the same in good order, as set out in said act, subject to the conditions therein expressed. Given under our hands and corporate seal of said company this —— day of ——, 18—." Which bond being executed by the parties aforesaid, and approved as aforesaid, and attested by the governor, shall entitle the company and their associates to all the rights conferred by this act: *Provided, however,* That said company may associate others with them before or after the execution of said bond: *And provided further,* That the Commonwealth shall have a lien upon all property of said company to secure a compliance with the stipulations of said bond.

(12) This act to be in force from its passage.

Approved March 9, 1868.

### AN ACT to amend and explain an act entitled "An act to incorporate the Green and Barren River Navigation Company," approved March 9, 1868.

Whereas an act entitled "An act to incorporate the Green and Barren River Navigation Company," approved March ninth, eighteen hundred and sixty-eight, authorizing said company to collect certain tolls from boats and other things navigating said rivers according to the rates established by the board of internal improvement, as then applied to the Kentucky, Green, and Barren river lines of navigation; and whereas the rates so established as applicable to the Kentucky River are not deemed applicable to Green and Barren rivers, and are misleading; and whereas complaints have been made that said company have violated the spirit of their charter by giving it a wrong construction, to the prejudice of the public, and in making changes not contemplated therein, and that are not authorized by law; and whereas it is clear that said company have vested rights under their said charter that cannot be impaired, but which may be confined to their just and legitimate limits: Therefore, to explain and limit the rights of said company in the protection of the public, while at the same time the vested rights of the said company must be respected:

*It is now enacted by the general assembly of the Commonwealth of Kentucky,* That the charges herein prescribed and limited may be charged by said company against boats, barges, and things navigating said line of navigation, and no greater charges therefor shall be made.

SEC. 2. That the rate of tolls authorized by said act to be charged against boats, according to the tonnage rule or principle, shall not apply to boats or things plying only between the dams; but all boats, barges, and other crafts plying only between the dams on slackwater in said line of navigation shall not be required to pay any other or greater tolls than such as were established by the board of internal improvement, and that were in force at the time of the passage of said act, and that were applicable alone to the Green and Barren river line of navigation, except as herein limited.

SEC. 3. No boat used exclusively in towing shall be required to pay tolls according to the rules of tonnage as claimed under said act. Such boats, in passing the locks and dams, shall only be required to pay two dollars therefor at each lock to said company.

SEC. 4. The charge of two dollars lockage claimed under said act shall not be paid on any raft of timber passing said locks and dams, but the charges shall be as fixed by the board of internal improvement, and it is as follows: For rafts fifteen feet wide and under, three cents per linear foot at each lock; over fifteen and under twenty feet wide, five cents per linear foot at each lock; rafts twenty feet wide and under thirty feet wide, six cents per linear foot at each lock; rafts thirty feet wide and under thirty-six feet wide, seven cents per linear foot at each lock.

SEC. 5. No flatboat or barge starting from above the influence of slackwater shall be required to pay any tolls except for passing through a lock, and that shall not exceed the rates prescribed by law.

SEC. 6. No flatboat or barge starting within the influence of slackwater shall be required to pay exceeding two dollars lockage and three cents per linear foot of each boat or barge at each lock; and the two dollars lockage herein authorized by this section shall not be chargeable unless the boat or barge actually passes through the lock.

SEC. 7. No flatboat or barge loaded with coal or stone or sawed lumber shall be required to pay exceeding two dollars lockage and six cents per linear foot for such boat or barge at each lock, but the two dollars lockage shall not be chargeable unless the boat or barge actually passes through the lock.

SEC. 8. This act shall take effect and be in force from and after its passage.

Approved March 15, 1876.

[Acts of 1878, page 513, chapter 482.]

*Be it enacted by the general assembly of the Commonwealth of Kentucky*, That section five of an act entitled "An act to amend and explain an act entitled 'An act to incorporate the Green and Barren River Navigation Company,' approved March ninth, eighteen hundred and sixty-eight," approved March fifteenth, eighteen hundred and seventy-six, be amended by inserting after the word "barge" the following: "Or rafts of logs or timber of any kind."

SEC. 2. That section six of said act be amended by adding, after the word "barge," whenever it occurs in said section, the following: "Or rafts of logs or other timber."

SEC. 3. This act shall be in effect from and after its passage.

Approved March 14, 1878.

AN ACT to grant the consent of the State of Kentucky to the acquisition by the United States of certain lands bordering on Rough River in said State, for the purpose of constructing canals, or erecting thereon dams, abutments, locks, lock keeper's dwellings, offices, and all necessary structures for the construction and maintenance of slack-water navigation on said river, and ceding jurisdiction over the same, and for imposing fines and penalties for willful injuries to the grounds, buildings, and appurtenances acquired under the provisions of this act.

*Be it enacted by the general assembly of the Commonwealth of Kentucky*, That whenever the United States shall make an appropriation, and shall be about to begin the improvement of Rough River, within the State of Kentucky, by means of locks and permanent or movable dam or dams with adjustable chutes, or by means of a canal, or any suitable structure to procure an easy and safe passage of boats, then the consent of the State of Kentucky is hereby given to the acquisition by the United States, by purchase or by condemnation, of any lands, buildings, or other property necessary for the purpose of erecting thereon dams, abutments, locks, lock keeper's dwellings, chutes, and other necessary structures for the construction and maintenance of slack-water navigation on said river, or for the purpose of constructing canals on the same, and the said United States shall have, hold, use, and occupy the said land or lands, buildings, or other property when purchased or acquired, as provided for by this act, and shall exercise jurisdiction and control over the same.

SEC. 2. *Be it further enacted*, That in case of failure of the United States to agree with the owners of any such lands as the United States may deem necessary for the purposes named in the first section of this act, it shall be lawful for the United States to apply for the condemnation of such land by petition to any judge of a court of record in or nearest to the county where the land may be situated, either in term time or in vacation, notice of the time and place of such application having been first duly given by publication for thirty days prior to the day of such application in some newspaper of general circulation, published in the county where the land lies, or, if the owner or owners reside in the State of Kentucky, by personal service upon the owner or owners of such land at least twenty days prior to such application; and thereupon it shall be lawful for such judge to appoint three disinterested freeholders of the county where such land lies as commissioners, and having been first duly sworn to well and duly appraise the damages due the owner or owners of said land proposed to be taken, shall report in writing to the said judge the amount of damages to be paid to the owner or owners of such land, which report, upon confirmation by said judge, shall be held as final and binding upon said owner or owners of said land; and upon the amount of such damages being paid to the owner or owners of said land, the title of such land shall vest in the United States, and such land shall be exempt from all taxes and assessments so long as it shall remain the property of the United States.

SEC. 3. *And be it further enacted*, That if any person or persons shall willfully or maliciously injure any of the lands, buildings, or other property acquired or held under the provisions of this act, such person or persons shall be liable to a fine of not less than twenty dollars, and to an imprisonment not exceeding six months, or both or either, at the discretion of the court, said offense to be prosecuted in any court of competent jurisdiction.

SEC. 4. This act shall take effect from and after its passage.

Approved April 22, 1884.

### AN ACT to change the name of Rough Creek, in Ohio, Grayson, and other counties, to that of Rough River.

*Be it enacted by the general assembly of the Commonwealth of Kentucky*, That the name of Rough Creek, in Ohio, Grayson, and other counties is hereby changed to that of Rough River.

SEC. 2. All acts in conflict with this act are hereby repealed.

SEC. 3. This act shall be in force from and after its passage.

Approved April 22, 1884.

### AN ACT to vacate and annul an act entitled "An act to incorporate the Rough Creek Navigation and Manufacturing Company," approved March eighth, eighteen hundred and fifty-six, and the several amendments thereto.

*Be it enacted by the general assembly of the Commonwealth of Kentucky*, That whereas the Rough Creek Navigation and Manufacturing Company was incorporated by an act of the general assembly, approved March eighth, eighteen hundred and fifty-six, and whereas the organization perfected under said act has ceased to exist, and all the rights, powers, and privileges created, authorized, and vested in said company by the terms and stipulations of said act have been abandoned for fifteen years last past; therefore, be it enacted, that all the rights, powers, and privileges authorized and conferred in said act, and the several amendments thereto be, and hereby are, canceled, vacated, and annulled.

SEC. 2. This act shall be in force from its passage.

Approved May 12, 1884.

[From the river and harbor act approved July 5, 1884.]

* * * * * * *

The Secretary of War is hereby directed to report to Congress at its next session, or sooner if practicable, the condition of the Green and Barren rivers * * * and the provisions and estimate of cost necessary to relieve the same from incumbrance, with a view to such legislation as will render the same free to commerce at the earliest practicable period.

* * * * * * *

### AN ACT to grant the consent of the State of Kentucky to the acquisition by the United States of certain lands within the Commonwealth bordering on Green and Barren rivers for certain purposes.

*Be it enacted by the general assembly of the Commonwealth of Kentucky, and it is hereby enacted by the authority of the same*, That whenever the United States shall, by purchase or otherwise, extinguish the claim of the Green and Barren River Navigation Company to take tolls and to exercise control over said rivers, the consent of the State of Kentucky is hereby given to the acquisition by the United States, by purchase or condemnation, of any lands, buildings, or other property necessary for the purpose of erecting dams, abutments, locks, lock keepers' dwellings, chutes, and other necessary structures for the construction and maintenance of slack-water navigation on said rivers, or for the purpose of constructing canals on the same; and the United States Government shall have title to the grounds and sites thus acquired, and all power, authority, and jurisdiction over the same which the Government of the United States may, under the Constitution of the United States and laws made in pursuance thereof, acquire over lands in the State ceded to it for similar purposes; but the State of Kentucky reserves the right to execute process lawfully issued under its authority within and upon said grounds, sites, rivers, and canals.

SEC. 2. That in case of failure of the United States to agree with the owner or owners of any such lands as the United States deem necessary for the purpose named in the first section of this act, it shall be lawful for the United States to apply for the condemnation of such land by petition to any judge of a court of record in or nearest to the county where the land may be situated, either in term time or in vacation, notice of the time and place of such application having been first duly given by publication for thirty days prior to the day of such application, in some newspaper of general circulation published in the county where the land lies, or, if the owner or owners reside in the State of Kentucky, by personal service upon the owner or owners of such land at least twenty days prior to such application; and thereupon it shall be lawful for such judge to appoint three disinterested freeholders of the county where such land lies as commissioners, and, having been first duly sworn to well and duly appraise the damages due the owner or owners of said land proposed to be taken, shall report in writing to the said judge the amount of damages to be paid to the owner or owners of such land, which report, upon confirmation by said judge, shall be held as final and binding upon said owner or owners of said land; and upon the amount of such damages being paid to the owner or owners of said land, the title of such land shall vest in the United States, and said land shall be exempt from all taxes and assessments so long as it shall remain the property of the United States.

SEC. 3. That if any person or persons shall willfully or maliciously injure any of the lands, buildings, or other property acquired or held under the provisions of this act, such person or persons shall be liable to a fine of not less than twenty dollars, and to imprisonment not exceeding six months, or both or either, at the discretion of the court, said offense to be prosecuted in any court of competent jurisdiction.

SEC. 4. That for the purposes contemplated by this act, the State of Kentucky hereby transfers and cedes to the United States the five locks and dams heretofore constructed by the State on said rivers, together with all the grounds and appurtenances belonging to the same. This grant to become effectual upon the extinguishment of the claim of the Green and Barren River Navigation Company, as provided in the first section of this act, and when the Government of the United States shall by law assume control of the improvement and navigation of said rivers.

SEC. 5. This act to take effect from its passage.

Approved February 20, 1886.

[From the river and harbor act approved August 11, 1886.]

* * * * * * *

The Secretary of War is hereby authorized and directed to ascertain the value and commercial importance of the works and property of the Green and Barren River Navigation Company, situated on the Green and Barren rivers, in the State of Kentucky; * * * and in order to acquire such information, the Secretary of War shall appoint a board of three competent engineers from the Engineer Corps of the United States Army, which board shall * * * report to the Secretary of War, who shall report thereon to Congress at the next succeeding session; and the cost of such examination shall be paid out of the sum appropriated by this act for surveys: *Provided*, That nothing herein shall be construed as committing Congress to the purchase of said works.

* * * * * * *

[From the river and harbor act approved August 11, 1888.]

* * * * * * *

For the purchase of the improvements known as the Green and Barren river improvements, one hundred and thirty-five thousand dollars: *Provided*, That no part of said sum shall be expended until a full and absolute conveyance of said improvements, together with rights of way, easements, piers, docks, and appurtenances of every nature, belonging to or connected with said improvements, by the owner or owners thereof, and the Attorney-General of the United States shall have certified to the Secretary of War that the title is perfect.

[From the river and harbor act approved September 19, 1890.]

* * * * * * *

The Secretary of War is hereby authorized and empowered to grant leases or licenses for the use of the water powers on the Green and Barren rivers, at such a rate and on such conditions and for such periods of time as may seem to him just, equitable, and expedient, said leases not to exceed the period of twenty years: *Provided*, That the leases or licenses shall be limited to the use of the surplus water not required for navigation. And he is also empowered to grant leases or licenses for the occupation of such lands belonging to the United States on said Green and Barren rivers as may be required for mill sites or for other purposes not inconsistent with the requirements of navigation, said leases or licenses not to extend beyond the period of twenty years; and all moneys received under such leases or licenses shall be turned into the Treasury of the United States, and the itemized statement thereof shall accompany the Annual Report of the Chief of Engineers. But nothing in this act shall be construed to affect any vested right, if such there be, of any lessee of water power on said river.

* * * * * * *

## REPORT OF MR. W. S. OVERSTREET, MASTER.

UNITED STATES ENGINEER OFFICE,
*Woodbury, Ky., June 30, 1904.*

CAPTAIN: I have the honor to submit herewith the following report of work under my supervision pertaining to the operating and care, etc., of Green and Barren rivers, Kentucky, for the fiscal year ending June 30, 1904.

### LOCK NO. 1, GREEN RIVER.

*Dam.*—The work of placing a concrete top on the dam has been commenced by Hollerbach & May, the contractors, and about one-half of the work completed.

*Miscellaneous.*—The lock walls and gates were kept cleaned from mud, ice, and snow; drift was removed from the upper approach and lock chamber; part of the old fence, 440 feet in length, was removed and replaced with a new board fence; all the other fences were repaired; all fences were whitewashed; some shade trees were set out and the lock gates painted. A small amount of stone was dumped into the lower shore crib where the filling had been washed out, and that part of the crib repaved.

### LOCK NO. 2, GREEN RIVER.

*Cottage and warehouse.*—The construction of the new cottage and warehouse at this lock was begun in May. Men were employed in breaking up 150 large dimension sandstones which had been left from the construction of the lock. This stone, with about 25 yards of limestone picked up on the banks of Barren River, was sufficient to build the foundations of the two buildings. The framing of the cottage and warehouse is now under way, and will soon be completed. All material received for these buildings which was liable to be injured by the weather was stacked in a dry place.

*Bridge.*—The small wooden bridge across the mill race on the reservation was rebuilt. Three thousand six hundred and eighty-two feet B. M. of beech lumber was used.

*Apron of dam.*—In February, 1904, during high water, a section of the apron, about 80 feet in length and about two-thirds of the distance from the lock wall to the abutment, was washed out. On account of high water, work will not be begun on the repairs until July or August.

*Miscellaneous.*—About 100 cubic yards of drift stone and slate were removed from back of the river wall of the lock and placed so as to prevent a cross current in the lower entrance near the gates; the weeds were kept out and removed from the reservation; mud, ice, snow, and drift were repeatedly removed from the lock walls and gates; the gates and skiff were scrubbed and painted; fences and outbuildings were whitewashed, and all necessary minor repairs were made. A small wash in the embankment was filled with earth.

### LOCK NO. 3, GREEN RIVER.

*Lower shore crib.*—The work of removing 250 linear feet of the old lower shore crib, which was begun last year, has been completed. The timber and stone above water were removed by a derrick boat—that below water by the dredge. It was all placed on the bank, and the unserviceable timber burned. The mud dredged was dumped into deep water.

| | | |
|---|---|---|
| Mud removed from crib | cubic yards.. | 82 |
| Stone removed from crib | do.... | 2,405 |
| Timber removed from crib | linear feet.. | 9,550 |

The work of constructing the new crib was begun on the 19th of September and completed late in October. Stone from the old crib and new beech timber were used in its construction.

| | | |
|---|---|---|
| Stone placed in crib | cubic yards.. | 1,834 |
| New timber used | linear feet.. | 20,732 |

*Dam.*—In July the construction of a rubble stone cofferdam around part of that portion of the dam which had been torn away the previous winter was begun and nearly completed. On the 8th of August all the cofferdam, with the exception of the wing next the abutment, was washed out during a rise in the river, and work was not resumed until the 31st of that month. Two rubble stone cofferdams were then constructed, the first inclosing 135 feet of the dam on the abutment side, the other

125 feet on the lock side. One hundred and ten feet and eight inches of the dam were then repaired, with the exception of a part of the upper breast, which was not removed as the timber in it was considered sufficiently sound to remain. Twenty feet and six inches of the lower slope resting on the stone bluff was rebuilt and sheathed so as to form a smooth slope on the stone below the crest. One hundred and ninety-five feet and seven inches of the upper slope was resheathed with two courses, the first of 4-inch, the second of 2-inch timber; the remaining 40 feet of the upper slope, next to the lock wall, had one course of 2-inch sheathing put on to stop leaks in old sheathing. All necessary repairs were made to the apron.

A sketch was made showing the exact amount of the repairs.

| | | |
|---|---|---|
| Stone, earth, and mud used in cofferdam | cubic yards.. | 2,142 |
| Sticks of timber removed from dam | number.. | 80 |
| Timber used in repairing dam | linear feet.. | 10,381 |
| Stone placed in dam | cubic yards.. | 3,332 |

A greater portion of the stone used in the cofferdams was utilized as filling for the dam and cribs. All unserviceable timber taken from the dam and crib was stacked and burned. All serviceable driftbolts in the old work were removed, straightened, and used in the construction of the new crib.

*Dredging.*—During high water there was a considerable quantity of mud deposited in the lock chamber and approaches. It became necessary to employ a force of men to scrape the mud away from the upper gates and to dredge out the lock approaches with a derrick boat rigged with a grapple bucket. About 100 cubic yards of mud were removed from the chamber and 50 cubic yards of mud from the upper approach.

*Miscellaneous.*—The ice, snow, mud, and drift were repeatedly removed from the lock, walls, and gates; a small wash in the bank was filled; the fence around the reservation was whitewashed; the flag pole, gauges, check posts, gates, irons, etc., were painted; all finished lumber, cement, and other material delivered for the warehouse, which were liable to be injured by the weather, were stored in a dry place. The construction of the warehouse will begin in July.

### LOCK NO. 4, GREEN RIVER.

*Washout back of land wall.*—The washout which had been made by high water back of land wall was filled with earth and broken stone, 145 linear feet of curbing were set about it, and 61⅞ cubic yards of concrete paving 6 inches thick laid. Sixty square yards of riprap were laid on the bank below the paving.

*Track to lumber house.*—The track which runs from above the upper end of lock wall to the warehouse was extended 438 feet to the lumber house on the opposite side of the reservation. Old material was used entirely in its construction. The track is used in handling heavy material between the warehouse, the lumber house, and the lock.

*Fencing.*—One thousand one hundred and ninety-two feet of new plank fence was constructed, replacing the old wire fence. This completes the fencing of the reservation on the lock side, also along the county road passing across the reservation from the town limits of Woodbury to the point of the stone bluff.

*Repairs to lower miter sill.*—On May 13 it was discovered that the lower miter sill had raised at the toe about 3 inches, causing a serious leak under the gates and making the operation of the upper gates very difficult. Two new needle coffer sticks were framed. On the morning of the 31st the lock was closed to navigation and two needle cofferdams put in, one above the upper gates and one below the lower ones. Clay backing was placed against each dam, but, as the river began to rise, work was suspended, and on account of continued high water it finally became necessary to take out both dams and temporarily open the lock to navigation in its broken condition. On June 21, at 7 a. m., the lock was again closed and two needle cofferdams were put in as before. The pit was pumped out by 9 a. m. on the 23d. The shore miter sill was found to be raised 7½ inches at the toe, the river sill 2½ inches. The drift bolts of the shore sill were cut, the sill removed, and the bolts backed out of it. The sill was then set to fit the gate and drift bolted to the old bed timber. Sixteen new drift bolts of 1-inch square iron 23½ inches long were used. The river sill was set back with a light pile-driver hammer, and seven 1 by 23½ inch square drift bolts and one 1½ by 32 inch round drift bolts were used in addition to the six already in the sill. As the old bed timbers were somewhat worn, shingles were placed under the sills to prevent leakage and neat cement mortar placed above the sill. At 3 p. m., June 25, the lock was reopened to navigation.

*Miscellaneous.*—The ice, snow, mud, and drift have been repeatedly removed from lock walls and gates; the capstans were reset; the gates, gauges, snubbing posts, etc., were painted; the stone portion of the lockmaster's cottage, the lumber house, tool house, and fences have all been whitewashed, and four rowboats for general use on the river constructed.

### LOCK NO. 5, GREEN RIVER.

*Bank protection.*—The bank below the lock wall was graded, 35 cubic yards of earth were removed, and 603 square yards of riprap laid.

*Miscellaneous.*—The drain pipe which carries the water across the reservation from a sump was extended 30 feet down the river. Minor repairs were made to fences, dwellings, and pumps, the fence was whitewashed, weeds were cut and removed from the reservation, ice, snow, mud, and drift were repeatedly removed from the lock walls and gates, and some shade trees were set out.

### LOCK NO. 1, BARREN RIVER.

*Warehouse.*—A new warehouse for the lock has been built according to plans approved. The work was begun in March and completed in June. The warehouse is situated on the upper part of the reservation and is near the river.

*Lower river crib.*—The old lower river crib was removed and the foundation dredged out. A new crib was not constructed.

*Repairs to apron of dam.*—Some small minor repairs were made to the apron, for which purpose the sound timber from the old lower crib was used.

*Miscellaneous.*—The porch floors of the dwellings, skiff, snubbing posts, gauges, and gates were painted; ice, snow, mud, and drift were repeatedly removed from the lock walls and gates; some shade trees were set out, and the fences were repaired and whitewashed.

### SNAG BOAT WM. PRESTON DIXON.

The snag boat has been engaged in snagging in the pools of Green and Barren rivers, in towing, making inspection trips, and in making other miscellaneous trips. She was also engaged in assisting in the construction of the cofferdams and repairs to main dam and lower shore crib at Lock No. 3, Green River, by loading, towing, and unloading stone and timber for them; in turning and returning barge *No. 4*, which was repaired; in loading and unloading tools, material, etc., at Lock No. 4, Green River; in transferring the local office several times to various places; in towing the floating plant to and from winter quarters; in assisting in picking up 25 cubic yards of rubble limestone for the cottage at Lock No. 2, Green River, and in towing material and assisting in the repairs to the lower miter sill at Lock No. 4, Green River. On June 20 the *Dixon* started on a trip to the Wabash River to remove snags and other obstructions from that river.

The work accomplished is summarized as follows:

| | |
|---|---|
| As snag boat: | |
| Snags removed below pool No. 1, Green River | 12 |
| Snags removed in pool No. 1, Green River | 46 |
| Snags removed in pool No. 2, Green River | 128 |
| Overhanging trees removed in pool No. 2, Green River | 63 |
| Snags removed in pool No. 3, Green River | 94 |
| Overhanging trees removed in pool No. 3, Green River | 44 |
| Overhanging trees deadened in pool No. 3, Green River | 5 |
| Stumps removed in pool No. 3, Green River | 5 |
| Snags removed in pool No. 4, Green River | 217 |
| Overhanging trees removed in pool No. 4, Green River | 14 |
| Snags removed in pool No. 1, Barren River | 97 |
| Overhanging trees removed in pool No. 1, Barren River | 27 |
| Snags removed in pool No. 2, Barren River | 34 |
| Miles run as snag boat | 640 |
| As towboat; | |
| Barges towed | 36 |
| Derrick boats towed | 29 |
| Quarter boat towed | 1 |
| Dredges towed | 3 |
| Scows towed | 3 |
| Miles run as towboat | 1,477 |
| Miscellaneous: | |
| Trips made | 4 |
| Miles run in miscellaneous work | 628 |
| Total miles run | 2,745 |

*Repairs.*—During the winter season the necessary repairs were made to the boat, consisting of overhauling all machinery, boilers and pipes, and supplying new fittings where needed; in patching the main deck and calking seams; in painting the entire outside of the boat, the kitchen, and machinery, and in making other necessary minor repairs. The boilers were inspected by a United States inspector of marine boilers.

### TOWBOAT EMERALD.

The *Emerald* has been employed in acting as dredge tender, in miscellaneous towing, in making a trip to Wabash River and returning with the Green River quarter boat, in making an inspection trip, and in making several other short trips to various parts of the river.

A synopsis of the work for the year is as follows:

| | |
|---|---|
| As towboat: | |
| Barges towed | 34 |
| Dredges towed | 8 |
| Scows towed | 14 |
| Quarter boats towed | 2 |
| Derrick boats towed | 15 |
| Miles run as towboat | 1,658 |
| As dredge tender: | |
| Scows towed | 130 |
| Cubic yards of material towed | 7,120 |
| Miles run as dredge tender | 35 |
| Miscellaneous trips made | 8 |
| Miles run on miscellaneous trips | 753 |
| Total miles run | 2,446 |

*Repairs.*—During the winter season the necessary repairs were made, consisting of putting in new bucket planks in the wheel, overhauling the machinery, supplying new fittings where needed, and painting the outside of the boat. Sixty-eight new tubes were put in the boiler, after which the boiler was inspected.

### DREDGE NO. 1, GREEN RIVER.

The dredge has been employed in dredging out the approaches at the various locks on Green and Barren rivers; in assisting in the construction of the lower shore crib and repair of dam at Lock No. 3, Green River, by dredging out the stone, mud, and timber below the water line of the old lower shore crib and in dredging rock below the dam for filling the new crib and dam; in removing the old lower river crib at Lock No. 1, Barren River; in dredging out the channel in Green and Barren rivers at various points, and in assisting in the repairs to the lower miter sill at Lock No. 4, Green River.

A synopsis of the work accomplished is as follows:

| | |
|---|---|
| At Lock No. 2, Green River: | |
| Cubic yards of mud dredged from lower approach | 200 |
| At Lock No. 3, Green River: | |
| Cubic yards of stone dredged from below dam | 3,282 |
| Cubic yards of earth dredged from below dam | 340 |
| Cubic yards of stone dredged from lower shore crib | 3,320 |
| Linear feet of timber dredged from lower shore crib | 4,555 |
| Cubic yards of mud dredged from above dam | 940 |
| At Lock No. 4, Green River: | |
| Cubic yards of gravel dredged from lower approach | 470 |
| Cubic yards of mud dredged from upper approach | 610 |
| At Lock No. 5, Green River: | |
| Cubic yards of mud dredged from lower approach | 620 |
| Cubic yards of mud dredged from upper approach | 600 |
| At Lock No. 1, Barren River: | |
| Cubic yards of mud dredged from lower approach | 520 |
| Cubic yards of mud dredged from upper approach | 260 |
| Linear feet of timber removed from old lower river crib | 1,100 |
| Miscellaneous dredging in Barren River: | |
| Cubic yards of gravel and mud dredged from Jones Hole | 460 |
| Cubic yards of gravel and mud dredged from Cow Ford | 150 |
| Cubic yards of gravel and mud dredged from Boat Island | 800 |
| Miscellaneous dredging in Green River: | |
| Cubic yards of mud dredged at Honakers Ferry | 1,150 |
| Cubic yards of mud dredged at Fall Over rock | 75 |

*Repairs.*—During the winter season the machinery was overhauled and all new fittings necessary were supplied; the decks were patched with new material and calked, some new sheaves were placed in the boom, a new dipper handle was framed and put in place, and the entire boat thoroughly cleaned and the outside repainted.

### REPAIRS TO QUARTER BOAT.

The Green River quarter boat, which had sunk while in use on Wabash River, was returned to Green River in March. Work was immediately begun in overhauling the boat. It was placed on the ways at Bowling Green, Ky., where it was found that an entire new bottom was needed. This was put on and the bottom and gunwales thoroughly calked. This work was delayed somewhat on account of high water. The cabin, which leaned to one side, was straightened; shores and braces were put in; the doors and windows were rehung and glazed where necessary; the entire boat was thoroughly scrubbed and painted; and all other necessary minor repairs made. The repairs were completed about the 1st of May and the local office transferred to the boat.

### MISCELLANEOUS REPAIRS.

Barge *No. 4* was injured by a tree falling across it. A new deck and bottom were put in and the material taken from this barge was used in putting a new deck on barge *No. 5.*

The machinery on both the derrick boats was overhauled and new fittings were supplied where necessary, the cabins and booms were painted, and the decks, gunwales, and rakes of both derrick boats, both scows, and four barges were patched and calked where necessary, and painted. All other machinery, tools, etc., have been kept in repair.

Very respectfully, your obedient servant,

W. S. OVERSTREET, *Master.*

Capt. H. BURGESS, *Corps of Engineers.*

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## H H 8.

## IMPROVEMENT OF ROUGH RIVER, KENTUCKY.

A complete synopsis of the projects under which the improvement of this river has progressed may be found on pages 2599 to 2602, Annual Report of the Chief of Engineers, 1899. See also page 500 of this report.

The work outlined in the existing project has been completed with the exception of snagging and removal of landslides, which class of work must be done from time to time as long as the sources of such obstructions are in existence.

No operations were in progress during the fiscal year, and the only work proposed under the project for the future is the removal of snags, slides, and similar obstructions from time to time, as may be required to maintain the channel in good navigable condition.

The funds now available being sufficient for the present, no additional appropriation is recommended.

No contracts for this improvement are in force. For commercial statistics see report for "Operating and care of lock and dam, Rough River, Kentucky."

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,324.89 |
| July 1, 1904, balance unexpended | 2,324.89 |
| July 1, 1904, outstanding liabilities | 17.27 |
| July 1, 1904, balance available | 2,307.62 |

APPROPRIATIONS.

| | |
|---|---|
| September 19, 1890 | $25,000 |
| July 13, 1892 | 15,000 |
| August 18, 1894 | 22,500 |
| June 13, 1896 | 43,000 |
| Total | 105,500 |

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## H H 9.

## OPERATING AND CARE OF LOCK AND DAM ON ROUGH RIVER, KENTUCKY.

The estimate and project for the operation and care of this lock and its appurtenant structures during the fiscal year ending June 30, 1904, contained the following items:

| | |
|---|---|
| Regular force | $750 |
| Repairs, supplies, etc | 450 |
| Total | 1,200 |

Expenditures during the year were for payment of lock tender, messenger service between the lock and nearest post-office, minor repairs to cribbing, removal of heavy drift from the dam, removal of deposit from the lock chamber and upper entrance, and removal of snags, overhanging trees, etc., from the channel below the lock, the quantities of work done under the latter headings being as follows:

| | | |
|---|---|---|
| Deposit removed from upper entrance to lock | cubic yards | 430 |
| Deposit removed from lock chamber | do | 50 |
| Overhanging trees removed | number | 10 |
| Floating snags removed | do | 17 |
| Large bowlders removed | do | 2 |

*Summary of expenditures on account of operating and care of Rough River, Kentucky, during the fiscal year 1903, showing general items and amount expended under each heading.*

| Item. | Amount. |
|---|---|
| Services | $769.53 |
| Material, supplies, etc | 45.13 |
| Miscellaneous | 24.25 |
| Total | 838.91 |

ALLOTMENTS.

| | |
|---|---|
| July 23, 1897 | $2,086.00 |
| July 22, 1899 | 714.97 |
| July 17, 1900 | 686.31 |
| July 10, 1901 | 763.66 |
| August 5, 1902 | 1,079.62 |
| July 20, 1903 | 664.03 |
| Total | 5,994.59 |

### COMMERCIAL STATISTICS.

*Statements of traffic and commerce passing Lock No. 1, Rough River, Kentucky, from July 1, 1903, to June 30, 1904.*

TRAFFIC.

| Kind of boat, etc. | Number. | Tonnage. |
|---|---|---|
| Passenger | 9 | 55 |
| Tow | 167 | 11,284 |
| Government | 6 | 374 |
| Barges | 216 | 71,460 |
| Small craft | 137 | 252 |
| Rafts | 115 | .......... |
| Total | 650 | 83,425 |

Total number of lockages during past fiscal year, 1,081.

COMMERCE.

| Articles. | Quantity. | Articles. | Quantity. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Sorghum | 2 | Ties, railroad | 4,158 |
| Straw | 3 | Hoop poles | 10 |
| Swine and sheep | 3 | Miscellaneous | 60 |
| Lumber | 1,114 | | |
| Timber | 27,726 | Total | 33,076 |

Number of passengers, 60.

For list of boats plying on this river see page 2686 of this report.

*Comparative statement of traffic and commerce at Lock No. 1, Rough River, Kentucky.*

| Fiscal year. | Traffic. | | | | | Commerce. |
|---|---|---|---|---|---|---|
| | Steamboats. | Barges and flats. | Rafts. | Miscellaneous. | Total. | |
| | | | | | | *Tons.* |
| 1891 | | | | | | 98,161 |
| 1892 | | | | | | 50,000 |
| 1893 | | | | | | 75,000 |
| 1894 | | | | | | 64,401 |
| 1895 | | | | | | 36,945 |
| 1896 | | | | | | 30,445 |
| 1897 | | | | | | 16,538 |
| 1898 | 81 | 70 | 178 | 154 | 483 | 15,488 |
| 1899 | 164 | 29 | 207 | 132 | 532 | 21,831 |
| 1900 | 260 | 72 | 270 | 168 | 770 | 41,411 |
| 1901 | 175 | 114 | 121 | 247 | 657 | 20,666 |
| 1902 | 98 | 105 | 111 | 191 | 505 | 21,703 |
| 1903 | 128 | 76 | 133 | 235 | 572 | 32,919 |
| 1904 | 182 | 216 | 115 | 137 | 650 | 33,076 |

## H H 10.

## PRELIMINARY EXAMINATION OF LITTLE WABASH RIVER, ILLINOIS, FROM ITS MOUTH TO CARMI.

[Printed in House Doc. No. 38, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith for transmission to Congress copy of a report dated September 3, 1903, by Maj. George McC. Derby, Corps of Engineers, on preliminary examination of Little Wabash River to Carmi, Ill., authorized by section 1 of the river and harbor act approved June 13, 1902.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors as provided for in sections 3 and 14 of said act, and attention is respectfully invited to the Board's report of October 29, 1903, in third indorsement thereon.

I concur in the opinion of the Board that it is not now desirable for the United States to undertake the improvement of this stream as proposed.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,*
*U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF MAJ. G. M'C. DERBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Louisville, Ky., September 3, 1903.*

GENERAL: I have the honor to submit the following report on an examination of Little Wabash River to Carmi, in compliance with the requirements of the river and harbor act approved June 13, 1902.

This river was examined in 1892 and reported upon by Lieut. Col. G. J. Lydecker, Corps of Engineers, as printed in the Annual Report of the Chief of Engineers for 1893, page 2570. I have had the river below Carmi reexamined, and append hereto the report of Mr. G. W. Shaw, assistant engineer, who made the examination.

The conclusion reached in 1892 was that the Little Wabash, a small tributary of the Wabash River, was not at that time worthy of improvement, but might become so if "the contemplated improvement of the lower Wabash should result in the establishment of any considerable regular traffic on that stream." The conditions on the Little Wabash and on the lower Wabash remain to-day about the same as they were in 1892. No substantial improvement has been made in the latter stream, and no considerable regular traffic has arisen. I am of the opinion that the Little Wabash to Carmi is not now worthy of improvement.

Very respectfully, your obedient servant,

G. McC. DERBY,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, September 4, 1903.*

Respectfully forwarded to the Chief of Engineers, U. S. Army, concurring in Major Derby's opinion that this river is not now worthy of improvement.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

Additional information has been requested.

By command of Brigadier-General Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 29, 1903.*

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of "Little Wabash River, Ill., to Carmi," the indorsement of the division engineer thereon, and all other data available.

This report is ordered in section 1 of the river and harbor act of June 13, 1902.

Little Wabash River empties into the Wabash River about 15 miles above its mouth. Its total length is about 250 miles. The town of Carmi, 34 miles above the mouth, has a population of about 3,000. The village of New Haven, 2 miles above the mouth, has a population of about 430. Five bridges cross the river between Carmi and New Haven; all of them would require modification to admit of steamboat navigation on the river.

In 1867 a private company attempted to build a wooden lock and dam at New Haven with a view to extending slack water up to Carmi. The company failed, and in 1868 the State legislature made an appropriation of $35,000 to finish the work, which was accomplished in 1869.

Owing to poor construction the lock was rendered inoperative within a year, and navigation was entirely suspended. In 1886 the State legislature made an appropriation for the removal of the structure, a part of which, however, still remains. The river between Carmi and New Haven is obstructed by several shallow rocky bars that render navigation impossible at low stages, even for light-draft vessels. The fall from Carmi to the mouth is about 13 feet.

The depth in the lower Little Wabash is governed by the stage in the Wabash, and there is ample depth as far up as New Haven whenever the Wabash is navigable. It appears that no great advantage would result from an improvement of the Little Wabash, at least until the improvement of the Wabash shall have been effected.

No commerce exists above New Haven. The only traffic on the river is the shipment of corn and wheat from New Haven during high stages of water. The amount of commerce reported for the past two years is as follows: 1901, corn and wheat, 6,150 tons; 1902, corn and wheat, 5,025 tons.

Any radical improvement of the Little Wabash would involve the construction of one or more locks and dams. The cost of such work and the cost of remodeling the bridges now spanning the stream would in the opinion of the Board be disproportionate to resulting commercial benefits. The Board believes, therefore, that it is not desirable for the United States to undertake the improvement of the "Little Wabash River to Carmi," Ill.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

### REPORT OF MR. GRANVILLE W. SHAW, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
*Louisville, Ky., July 23, 1903.*

MAJOR: I have the honor to submit the following report on preliminary examination of the Little Wabash River, Illinois, from Carmi to its mouth, made July 9, 1903:

The Little Wabash River is about 250 miles long from its mouth to its source in Shelby County, Ill. It flows through Effingham, Clay, Wayne, and White counties, and along the northeast boundary of Gallatin County to its junction with the Wabash River, about 15 miles above the mouth of the latter.

There is at present no traffic on the Little Wabash River above New Haven, about 2½ miles above its mouth.

In 1836 the legislature of Illinois declared the Little Wabash a navigable stream up to the northern boundary of Clay County, a distance of about 180 miles, but no definite information could be obtained of the character and amount of commerce on the river.

In 1867 a private company made an attempt to build a wooden lock and dam at New Haven for the purpose of extending slackwater up to Carmi, 34 miles above the mouth of the river. The company having exhausted its funds in a small amount of work, and paying for overflowed lands, damages, etc., turned over the work to the State of Illinois, and in 1868 an appropriation of $35,000 was made by the legislature to finish the lock and dam, and the work was completed under the canal commission of that State in 1869. The lock was used for about one year, when through defective construction the gates could no longer be operated, and navigation became entirely suspended. After a few years the dam was partly destroyed by fire, and in 1886 the legislature of Illinois provided an appropriation for the removal of the remainder of the structure. About 80 feet of the dam was removed in 1887, when the appropriation became exhausted. There remain now only a portion of the lock, and part of the abutment on the other side of the river. An examination of the site made in 1892 gave the following dimensions of the lock and dam, which were built on a foundation of sandstone rock: Dam 24 feet wide, 17 feet high, with lift of 14 feet; lock chamber 150 feet long between miter sills, and 36 feet clear width of chamber. About $60,000 were expended in the project.

At Carmi, 34 miles above the mouth of the river, there is a dam clear across the river. It has a lift of about 10 feet, and is used to produce a pool above Carmi which supplies sawmills with logs and a flour mill with water power for about nine months of the year.

From Carmi to New Haven the river is a series of deep pools, with four or five rock bars of more or less extent. At the time of the examination the river was not at its lowest stage, but I was informed that the flow over the bars at low water would not exceed 30 or 35 cubic feet per second.

The river is about 200 feet wide at Carmi, and averages about 250 feet from New Haven down to the mouth.

The old dam had a lift of about 14 feet, which gave a depth of 2 feet on the foot of the dam at Carmi. As the slope below New Haven is very flat, it is estimated that the fall from Carmi to the mouth of the river is about 13 feet. That portion of the river between New Haven and the mouth—about 2½ miles—is deep and without bars, so that when Wabash River is navigable boats can easily ascend to New Haven. I am informed that there are a number of submerged snags between New Haven and the mouth, and there is a considerable amount of overhanging and fallen timber along the banks.

There are five bridges across the river between Carmi and New Haven, as follows: One at New Haven; one near Emma post-office, a small settlement about 11 miles below Carmi; one about 3 miles below Carmi, and two at Carmi, one of the latter being a railroad bridge. These bridges have stone or steel and concrete piers and abutments and iron or steel superstructures.

The only traffic on the river for a number of years has been the shipment of wheat and corn, which is stored in warehouses at New Haven and boated out in high stages. The extent of these shipments as obtained from the largest shipper at New Haven is as follows:

| | Bushels. |
|---|---|
| Amount carried by river in 1901: | |
| Wheat | 100,000 |
| Corn | 90,000 |
| Amount carried by river in 1902: | |
| Wheat | 80,000 |
| Corn | 75,000 |

The result of the examination indicates that when the Wabash River is navigable there is no trouble in reaching New Haven, and that, while there is generally a navigable depth in the Little Wabash to that point, it can not always be utilized because of shallow water in the Wabash River.

If the snags and overhanging and fallen timber were removed, it is evident that navigation to New Haven, the highest point to which any traffic goes, is entirely dependent on the improvement of the Wabash River.

As to that portion of the river between Carmi and New Haven, it is doubtful if the commerce to be anticipated would justify the expense of improvement. All bridges would have to be raised or provided with draws, and in a number of places farm lands would be submerged.

* * * * * * *

Very respectfully, your obedient servant,

GRANVILLE W. SHAW,
*Assistant Engineer.*

Maj. GEO. McC. DERBY,
*Corps of Engineers, U. S. Army.*

## H H 11.

## PRELIMINARY EXAMINATION OF OHIO RIVER AT THE HEAD OF THE FALLS AT LOUISVILLE, KENTUCKY.

[Printed in House Doc. No. 349, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 28, 1903.*

SIR: I have the honor to submit herewith for transmission to Congress a report, dated September 22, 1903, by Maj. George McC. Derby, Corps of Engineers, and report supplementary thereto, dated December 1, 1903, by Lieut. Harry Burgess, Corps of Engineers, upon preliminary examination, authorized by the river and harbor act approved June 13, 1902, of "Ohio River, at the head of the Falls at Louisville, with a view to the enlargement of the present dam or the construction of a new one."

In recent years the work of improvement by the General Government at this locality has consisted in the enlargement of the basin immediately above the locks of the Louisville and Portland Canal, the enlargement of the head of the canal, and straightening, deepening, and controlling the flow of water of the Falls through Indiana Chute, and this project is still in process of execution.

The plan of improvement recommended by Major Derby contemplates raising the existing structures and building others, so as to form above the Falls a continuous dam across the river, part fixed and part movable, with a portion of its crest 12.7 feet and the remainder 11.5 feet above the zero of the upper canal gauge, the cost of such portions of this work as are not included in the existing project being estimated at $298,000.

Major Derby's report was referred, as required by law, to the Board of Engineers for Rivers and Harbors, created by section 3 of the river and harbor act approved June 13, 1902. In its report of November 4, 1903, the Board, for the reasons set forth therein, expressed the opinion that suitable regulating works above the Falls of the Ohio River, added to or in modification of those now built or projected, with a view of securing a pool level of 8 feet on the upper canal gauge, can probably be constructed within the amount estimated by the district officer for a higher pool level, and that the resulting commercial benefits will far outweigh the cost.

The Board also recommended that the district officer be directed to submit a final estimate of cost, based upon a pool at the level of 8 feet on the upper canal gauge, and upon the use of types of structure approved by experience. The estimate thus asked for by the Board is contained in the report of Lieut. Harry Burgess, above referred to, the cost of such improvement being estimated at $219,000, in addition to that of the work covered by the existing project, and in the opinion of the Board it is desirable for the United States to undertake such work.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## REPORT OF MAJ. G. M'C. DERBY, CORPS OF ENGINEERS.

United States Engineer Office,
*Louisville, Ky., September 22, 1903.*

General: I have the honor to submit the following report on the preliminary examination of the "Ohio River, at the head of the Falls at Louisville, with a view to the enlargement of the present dam or the construction of a new one," in compliance with the provisions of the river and harbor act of June 13, 1902, and your letter of March 2, 1903.

The transmission of this report has been long delayed pending the completion and consideration of the plans of the Ohio Falls Hydraulic and Manufacturing Company for the development on a greatly increased scale of the water power of the Falls, which has long been used for manufacturing purposes.

This company made application in February, 1903, for a permit to build a dam and do work in the channel of the river, involving the expenditure of some millions of dollars and radically affecting the navigability of the river at and above the Falls. These plans have not as yet been so matured by the company's engineers as to admit of action being taken on the application for a permit, nor to constitute a fixed element in the problem now under consideration, namely, the enlargement of the present dam or the construction of a new one. I regret that it is not practicable to await longer the development of the hydraulic company's plans. As, however, the water power of the Falls can be made to average upward of 200,000 horsepower, it is believed that, in view of the recent improvements in the electrical transmission of power, the construction of a dam at Louisville that will make this water power available for commercial purposes is a probability of the near future that should be reckoned with in connection with the improvement of navigation, the more so as the two interests need not necessarily conflict with each other, but, on the contrary, might readily be so adjusted as to be mutually advantageous.

The Falls of the Ohio at Louisville have been under improvement for many years, and the dam in question is one of the appurtenances of that improvement, originally built, in part, in 1871, and rebuilt, raised, and lengthened from time to time in later years. I submit herewith a drawing showing the locality and the location of the dam. It will be observed that the dam does not extend continuously across the river, there being a gap of 638 feet for the channel of Indiana Chute, the southerly 160 feet of which may be closed at a stage of 5 feet, upper canal gauge, by raising a Boulé movable dam; an opening 500 feet wide across Middle Chute, which may be closed in like manner at a stage of 5 feet; and a third opening 685 feet wide at the end of the north wall of the canal, which can be closed by raising a Boulé dam, the crest of which is at 8 feet, upper canal gauge. The fixed portion of the dam between the last named Boulé dam and the Middle Chute is 1,812 feet long, is built of concrete, and its crest is at elevation 8 feet, upper canal gauge.

The fixed portion between the Middle Chute and Indiana Chute is 1,000 feet long, is built of cribs filled with stone, and its crest is at 5 feet, upper canal gauge. The entire length of a dam on the line of the existing structure would be 5,227 feet, including 592 feet north of Indiana Chute and across the mill race of the Ohio Falls Hydraulic and Manufacturing Company. The purpose served by the dam has been to increase the depth of water in the canal at low stages by checking the flow of water over the Falls, without in any way obstructing the channel of Indiana Chute, and without obstructing navigation through Middle Chute when the river is at such a stage as to make that chute navigable. The Boulé dam at the head of the canal wall permits the flow of the river to pass unobstructed at stages above 8 feet, keeping the head of the canal comparatively free from mud and sand and drift which might otherwise accumulate in large quantities at high stages.

The existing plans for the improvement of the Falls of the Ohio contemplate widening the deep basin at the head of the canal by rock excavation, at an estimated cost of $136,000 for completion, and the construction of certain dikes and other works designed to make Indiana Chute available for descending coal-barge navigation at a stage of 8 feet, instead of 9.5 feet as at present. This improvement of Indiana Chute is estimated to cost $466,180. The present approved plans contemplate no improvement of the low-water conditions.

The lowest water on record is 1.7 feet on the upper canal gauge, and for each of the past five years it has been 2.8, 2.3, 2, 2.2, and 3.1 feet. At these stages the chutes across the Falls are nôt navigable at all, and traffic through the canal is limited to small craft drawing only the amount of water shown by the gauge.

Any enlargement of the dam at the head of the Falls which would stop the flow of water through Indiana Chute would greatly improve the low-water conditions at Louisville Harbor, giving greater depth in the canal and in the Ohio for a long distance above Louisville. Pending the improvement of the Ohio from Louisville to Evansville, increased low-water depth through the canal would be of comparatively little value, as there is a bar only 2½ miles below the locks, on which the usual low-water depth is only 3½ feet, and other bars below, over which no greater draft can be carried than can pass the canal in its present condition. Above the Falls, however, conditions are most favorable in the Ohio, the slope of the stream being very slight as far as Madison, Ind., 45 miles above Louisville. If the dam were made continuous and its crest raised to maintain low-water pool level at 12.7 feet, upper canal gage, it would give slack-water navigation for more than 70 miles on the Ohio, with upward of 6 feet on the lower miter sill of Lock No. 1, Kentucky River, thus connecting with 158 miles of slack-water navigation already secured on that stream by the existing system of locks and dams.

Such an improvement would not be very expensive, as the existing locks at Louisville are designed for lifting to an elevation of 12.7 feet on the upper canal gauge and much of the existing dam could be utilized with very little alteration and enlargement. For the past five years the freight tonnage passing Louisville has been—

| Year. | Through the canal. | Over the Falls. | Total. |
|---|---|---|---|
| 1899 | 978,221 | 858,831 | 1,837,052 |
| 1900 | 1,326,717 | 261,988 | 1,588,706 |
| 1901 | 1,216,906 | 1,005,777 | 2,222,683 |
| 1902 | 847,710 | 621,835 | 1,472,545 |
| 1903 | 992,898 | 1,043,529 | 2,036,427 |
| Average | 1,072,490 | 758,992 | 1,831,482 |

In addition to the above there is a heavy traffic which does not actually pass Louisville, but reaches that part of the Ohio extending from Louisville to the mouth of the Kentucky River. In 1900 and 1901, the latest years for which I have the figures, it averaged 2,204,000 tons of freight, so that the total river tonnage that now utilizes the 70 miles of river that would be improved by enlarging the dam at the head of the Falls is about 4,035,000 tons per annum. The passenger traffic is also very heavy, having averaged about 1,563,650 passengers per annum during the same periods. It is believed that this large commerce now utilizing this portion of the Ohio River is destined to greatly increase in future years.

For the reasons outlined above, I am of the opinion that the Ohio River at the head of the Falls at Louisville is well worthy of improvement by the enlargement of the present dam, and, in fact, that such improvement offers an exceptionally favorable opportunity to confer great benefits upon commerce at very low cost. Records and surveys of the Falls of the Ohio are already quite complete and are sufficient to form the basis of an estimate.

A dam across a river, compelling vessels to resort to the slow and tedious process of passing through a lock instead of continuing their journeys uninterrupted through a free and open channel, is of course to a certain extent a drawback to any such improvement of a stream. This is aptly illustrated at Louisville, where the existing project contemplates the expenditure of $466,000 for the sole purpose of dispensing with the use of the locks while the river happens to be at a stage between 8 feet and 9.5 feet. It follows that when dams are necessary for the improvement of a great river like the Ohio, it is most important that the lift of each dam shall be as great as safety and the practicability of operation will permit, since the greater the lift of each dam the less will be the total number of dams required. The total cost will also be less. In the general case the character of the foundation available on the Ohio is such that dams of very low lift have usually been adopted. The average lift of the 38 dams heretofore approved for this stream is only 7 feet. At Louisville, however, a good rock bottom is everywhere available, so there seems to be no reason why the dam should not be given a height of 13.7 feet above the sill in Indiana Chute, making the upper pool level 12.7 feet on the upper canal gauge, which is the level to which the existing locks are now used.

With the low-water pool at 12.7 feet on the upper canal gauge, the navigable pass in Indiana Chute could be opened on the approach of a rise corresponding to a 9.5-foot stage, in order not to compel vessels to pass through the locks at a stage when 6.5 feet can be carried over the Falls through the chute. This could be done without decreasing the navigable depth at the upper end of the pool to less than 9 feet. In like manner the navigable pass could be used on the approach of a rise corresponding to an 8-foot stage, upper canal gauge, after the completion of the proposed improvement of Indiana Chute, which contemplates making the chute available when the gauge reaches 8 feet, for vessels drawing 6.5 feet. This latter improvement has not yet been begun and it is an expensive work in proportion to the benefits that would accrue, as for the past five years on the average, only 174 barges and 407 boats per annum would have been benefited had the improvement been completed; so it can advantageously be postponed until after the enlargement of the dam, when there may be greater need of it, and when the work can be done more economically, as the enlarged dam would serve the purpose of a cofferdam and the dike on the south side of Indiana Chute could be more favorably located.

The existing approved project (Annual Report Chief of Engineers 1902, p. 1975) provides for removing the old crib cross dam between the chutes and replacing it by a movable dam with its crest at 8 feet on the gauge, at an estimated cost of $75,000. This item would have to be increased by $25,000 to allow for increasing the height of this dam to 12.7 feet, upper canal gauge.

The project also contains an item of $2,500 for raising to 9.5 feet the Boulé dam adjoining the north wall of the canal. To raise this dam to 12.7 feet will cost about $13,500, involving an increase of $11,000 in the estimates as now approved.

The low-water discharge of the Ohio at Louisville being about 8,000 cubic feet per second, the concrete dam south of the middle chute can advantageously be used as a fixed weir, with its crest at about 11.5 feet on the upper canal gauge. To raise the dam to this height would require about 4,000 cubic yards of concrete, which at $8 per cubic yard would cost about $32,000.

The approved project contemplates no change in the movable dam across the Middle Chute. This dam is of the Boulé type, is in poor condition, and will require renewal within a few years, the iron work being much worn and corroded. A new dam on the same site and with its crest at 12.7 feet would cost about $100 per running foot, or $50,000.

The navigable pass in Indiana Chute should be not less than 700 feet wide, and would probably require an expensive type of dam that would admit of being maneuvered more promptly and readily than the Boulé dam. Its cost is estimated at $200 per running foot, $140,000, which would also include the necessary drift chutes.

A concrete dam across the old mill race north of Indiana Chute would cost about $13,000.

I have not thought it necessary to enter into any discussion of the type of movable dam best suited to this somewhat unusual location, nor of the extent to which fixed concrete dams could advantageously be substituted for some of the movable dams included in the old approved project and provisionally retained and estimated for in this. The estimates are sufficient to leave to the constructing engineer considerable latitude in these particulars, which can be fully considered and determined later. I would suggest, however, that at least for the navigable pass in Indiana Chute, where very rapid currents must be contended with, there would be many advantages in a type of dam consisting of an upstream face of iron or wood or concrete, inclined at such an angle to the horizontal as to do away with all overturning tendency, supported by the necessary trestles or arches and mounted upon trucks or wheels running upon a railroad track on the foundation. Such a dam could be opened or closed by running it in or out on the track like a train of cars, and would have the further advantage that all the metal work except the track could be withdrawn from the water when not in use. A bear-trap dam of any length could be operated on this principle in sections coupled together to form a train.

To recapitulate, the total estimate for the enlargement of the present dam so as to maintain pool level at 12.7 feet, upper canal gauge, would be, in addition to the estimates of the existing approved project, as follows:

| | |
|---|---|
| Raising Boulé dam at canal wall (in addition to item in existing project) | $11,000 |
| Raising fixed concrete dam | 32,000 |
| Movable dam across Middle Chute | 50,000 |
| Movable dam between the chutes (in addition to item in existing project) | 25,000 |
| Movable dam across Indiana Chute | 140,000 |
| Concrete dam across mill race | 13,000 |
| Administration and contingencies, 10 per cent | 27,000 |
| Total | 298,000 |

[Ninth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 14, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The estimate of cost of suitable regulating works above the Falls of the Ohio at Louisville, Ky., with a view to securing a pool level of 8 feet on the upper canal gauge, requested by the Board of Engineers for Rivers and Harbors in fifth indorsement hereon, and which accompanies this report, has been reviewed by the Board.

It is estimated by the district officer that the improvement suggested by the Board will cost, in addition to the approved project, the sum of $219,000.

Having in mind the amount and character of the present and prospective commerce involved, the extent of the river that would be improved, and the advantages to result from a large and commodious harbor at Louisville, the Board remains of opinion that the benefits to be expected from the proposed improvement far outweigh the estimated cost thereof, and that it is desirable for the United States to undertake this work, and the Board so recommends.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION.

UNITED STATES ENGINEER OFFICE,
*Louisville, Ky., December 1, 1903.*

GENERAL: In compliance with directions of sixth indorsement, * * * I have the honor to submit the following estimate for the works contemplated in the fifth indorsement on same paper.

The works contemplated, as set forth in paragraph 6 of fifth indorsement, are:

(1) Raising crest of Boulé dam across the Middle Chute; (2) closing Indiana Chute by a movable dam; (3) building a fixed dam from the Indiana shore to the Indiana Chute, all with crests 8 feet above the zero of the upper canal gauge. The object of these works is to secure a pool level of 8 feet at the head of the Falls of the Ohio.

The existing Boulé dam across Middle Chute is not in good repair and will in a few years have to be renewed. For this reason it is thought advisable to construct a new dam instead of raising the crest of the old dam to the 8-foot level. The estimate for a new Boulé dam with crest at 8 feet is $75 per foot, making a total for 500 feet of $37,500.

Indiana Chute at the entrance is 638 feet wide; this opening it is proposed to close with a Chanoine wicket dam with crest at + 8 and sill at — 1, upper canal gauge, the latter being the present reference of the bottom at the entrance of Indiana Chute. It is proposed that this dam be raised and lowered from a service trestle of the usual type, the cost of which is included in the estimate for the dam. The maneuvering may be done also from a maneuvering boat, for which service one of the boats belonging to the Louisville and Portland Canal may be used, or a new boat may be provided later. It is estimated that such a dam, including abutments and service bridge, will cost $200 per linear foot, making for 650 feet (a slight increase in present width of entrance) a total of $130,000.

A fixed dam from the Indiana Chute to the Indiana shore will be, approximately, 600 feet long. This dam should be of concrete, with crest at 8 feet. Based on the cost of the existing concrete dam south of Middle Chute, this dam will cost $25 per foot; or, for 600 feet, $15,000.

To recapitulate, the cost of raising the crest of all parts of the cross dam to 8 feet, in addition to the estimate for the present approved project, will be as follows:

| | |
|---|---|
| 500 feet Boulé dam across Middle Chute, at $75 | $37,500 |
| 650 feet Chanoine wicket dam, including abutments, service bridge, etc., at $200 | 130,000 |
| 600 feet of concrete dam north of Indiana Chute, at $25 per foot | 15,000 |
| Contingencies, 20 per cent | 36,500 |
| Total | 219,000 |

No map is thought to be necessary with this report, as the inclosure to Major Derby's report of September 22, 1903, shows the location of the different sections of the cross dam. Attention is respectfully invited to that report and inclosure.

Very respectfully, your obedient servant,

H. Burgess,
*First Lieut., Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, December 5, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

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## H H 12.

## PRELIMINARY EXAMINATION AT SAND ISLAND, OHIO RIVER, KENTUCKY.

[Printed in House Doc. No. 251, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith for transmission to Congress report dated July 26, 1902, by Maj. E. H. Ruffner, Corps of Engineers, on preliminary examination authorized by the river and harbor act approved June 13, 1902 at "Sand Island, in the Ohio River, with a view to ascertaining the desirability of acquiring a sufficient portion thereof for the mooring of boats or barges and the making up of tows passing through the Louisville and Portland Canal."

The emergency river and harbor act approved June 6, 1900, ordered a preliminary examination, with a view to ascertaining the desirability of acquiring Sand Island, and report thereon, dated June 20, 1900, is printed in House Document No. 68, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 2817. In this report the officer in local charge at that time, Capt. George A. Zinn, Corps of Engineers, expressed the opinion, concurred in by the division engineer, Col. Henry M. Robert, Corps of Engineers, that it was not desirable to purchase the island, "as it bears no relation to any project of improvement now in force or contemplated." The probable cost of purchasing the island was then given as $25,000.

The present examination has in view the acquisition of a portion of the island for the purpose quoted above. In the opinion of Major Ruffner, concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, it is not necessary or desirable for the United States to acquire any portion of Sand Island in the interests of navigation or commerce.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and attention is respectfully invited to the Board's report of April 28, 1903, in third indorsement thereon.

The investigation of the Board included a visit to the locality by a committee and the holding of a public hearing for all parties interested. For the reasons given in its report the Board believes that it is not desirable for the United States further to consider the purchase of any or all of Sand Island until other methods of providing mooring facilities by artificial means shall have been thoroughly investigated.

I concur in the conclusions of the Board.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS.

Engineer Office, United States Army,
*Cincinnati, Ohio, July 26, 1902.*

General: Having been charged by circular letter with the preliminary examination, in accordance with the river and harbor act approved June 13, 1902, of the following locality—

> Sand Island, in the Ohio River [Kentucky], with a view to ascertaining the desirability of acquiring a sufficient portion thereof for the mooring of boats or barges and the making up of tows passing through the Louisville and Portland Canal—

the following is submitted:

This subject was fully reported upon by Capt. George A. Zinn, Corps of Engineers, in the Report of the Chief of Engineers for 1901, pages 2817-2819, Part 4. The only difference between that and this requirement is that this examination looks forward to the acquirement of "a sufficient portion," and the prior one to the purchase of the whole island.

Of course the operation of all fleets through locks requires mooring ground, and of course navigation is facilitated by having no charges for the privilege of mooring, but otherwise the acquirement of Sand Island, or of any portion of it, has no relation to the plan of improvement of the river.

I have only to say that I fully agree with the ideas so clearly expressed in Captain Zinn's report, which covers the ground perfectly, and in my opinion no further examination or survey is required.

Very respectfully, your obedient servant,

E. H. RUFFNER,
*Major of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, August 2, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army.

I concur in the opinions implied and expressed within, that it is not necessary or desirable for the United States to acquire any portion of Sand Island in the interests of navigation or commerce, and that no further local examination or survey is now required.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 13, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 28, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of "Sand Island, in the Ohio River, with a view to ascertaining the desirability of acquiring a sufficient portion thereof for the mooring of boats or barges and the making up of tows passing through the Louisville and Portland Canal," the indorsement of the division engineer thereon, and other data at hand, including a report upon a preliminary examination made in 1900.

On April 3, 1903, a committee of the Board inspected the situation at Sand Island, and conducted a public meeting of parties interested in the matter of its purchase. At this meeting the owners of the island were represented, but were unwilling to name a price at which they would sell to the United States, or to part with a portion of the property without selling the whole. It appeared to the Board that title could be secured only at an exorbitant cost, or rather condemnation proceedings.

While the advantage of mooring facilities immediately below the Louisville and Portland Canal to expedite the passage of tows through the locks is apparent, yet it is not plain that the purchase of Sand Island is the best means whereby these facilities can be furnished; nor does the Board consider that the United States should expend any great sum to this end. It appears not impossible that adequate conveniences may be provided by means of mooring cribs or dolphins at a cost which shall be reasonable and less than that of acquiring part or all of Sand Island.

For this reason the Board believes that it is not desirable for the United States further to consider the purchase of any or all of Sand Island in the Ohio River until the alternative method of providing mooring facilities by artificial means shall have been thoroughly investigated.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

## H H 13.

## PRELIMINARY EXAMINATION OF POND CREEK OR RIVER, KENTUCKY.

[Printed in House Doc. No. 174, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 7, 1903.*

Sir: I have the honor to submit herewith reports dated July 26, 1902, and September 13, 1902, by Maj. E. H. Ruffner, Corps of Engineers, on preliminary examination of Pond River, Kentucky, ordered by the river and harbor act of June 13, 1902.

In the opinion of Major Ruffner, concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, Pond River is not worthy of improvement by the General Government, and the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act, concludes in its report of January 8, 1903, that it is not desirable that the United States should commence this improvement.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS.

Engineer Office, United States Army,
*Cincinnati, Ohio, July 26, 1902.*

General: Having been placed in charge of the preliminary examination of Pond River, Kentucky, by circular letter, as provided for in the river and harbor act approved June 13, 1902, the following is submitted: Since the passage of the river and harbor act a special act has been approved giving private parties the right to improve this stream by locks and dams under certain restrictions stated in the act. This act had been approved by the Engineer Department and by the Secretary of War before its passage, and in my judgment the act does away with the necessity of this survey or examination, as the parties now licensed by the act will make all of the improvements needed for the proper use of this river for all of the ends it can serve.

Very respectfully, your obedient servant,

E. H. Ruffner,
*Major of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[Third indorsement.]

Engineer Office, U. S. Army, Central Division,
*Cincinnati, Ohio, August 19, 1902.*

Respectfully returned to the Chief of Engineers, United States Army.

The passage of the special act referred to within is not conclusive evidence, in my opinion, that Congress thereby intended to waive or repeal the requirements of the river and harbor act as respects the examination in question. I therefore recommend that the district engineer be requested to submit a fuller report in the matter, including information concerning the commercial importance of the stream and definite expression of opinion as to the advisability of its improvement by the General Government.

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G. J. Lydecker,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 23, 1902.*

Respectfully returned to Major Ruffner, inviting attention to the recommendation of the division engineer in third indorsement hereon, which is concurred in.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Fifth indorsement.]

U. S. ENGINEER OFFICE,
*Cincinnati, Ohio, September 13, 1902.*

Respectfully returned to the Chief of Engineers, United States Army, attention being invited to the fuller report herewith.

E. H. RUFFNER,
*Major, Corps of Engineers.*

[Sixth indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, September 15, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army.

For the reasons indicated by Major Ruffner in his accompanying report of September 13, 1902, I concur in his opinion that the Pond River is not worthy of improvement by the United States.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 23, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Eighth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., January 8, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of Major Ruffner upon the preliminary examination of Pond River, Kentucky, the views of the division engineer, and a letter[a] from Messrs. Gordon & Gordon, interested parties.

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[a] Not printed.

The Board is of the opinion that the present or prospective commerce on Pond River is not sufficient to warrant its improvement. Improvement on other rivers in this locality, larger than Pond River, has failed to be of such benefit to commerce as was originally expected. The Board is therefore constrained to believe that it is not desirable that the United States should commence this improvement.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

## SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cincinnati, Ohio, September 13, 1902.*

GENERAL: Since rendering report July 26, 1902, in the matter of preliminary examination of Pond River, Kentucky, new matter is before me, and the following additional and special report is submitted:

I am informed by Gordon & Gordon, lawyers, Madisonville, Ky., that they were instrumental in getting the bill passed for Mr. Anton Brucken (Public No. 251) to construct locks and dams in Pond River in the State of Kentucky, and to give the consent of Congress thereto. These gentlemen were in hopes that Mr. Brucken would be able, with what means he could gather, to make the desired improvements without governmental aid; but now, after having constructed two dams, Mr. Brucken finds that he is without means to proceed further or to construct the dam farther down the river, which is essential to the proper working of the improvements already made. The gentlemen then give their reasons for thinking that the improvement of the river would be of value to the adjoining country, and state that such development can only be properly done by the improvement of this stream. They ask that a survey be made, and offer to furnish all assistance in their power. This information removes my reason for not expressing myself more fully about this stream.

In the report for 1887, page 1901, Maj. James C. Post, Corps of Engineers, U. S. Army, very briefly describes the Pond River as follows:

> Pond River, a tributary of Green River, is a narrow, crooked stream; it is principally used for floating logs to market; its capacity is so small that it is hardly probable that any improvement would develop much commerce. It is not, therefore, considered worthy of improvement.

Pond River is one of the smallest tributaries of any of the great Kentucky streams; rising in one county, it flows between two others, bordering partly on a third, and empties into Green River a short distance below Lock No. 2; it has a less drainage area than Rough River, on which is a small lock furnishing navigation as far as Hartford, and which is of use mainly as a logging stream. Experience has shown that only the tiniest river craft use the Rough River lock, and there is no reason to think that Pond River would support or induce more navigation than is found on Rough River. On the contrary, the stream is smaller and, aside from logging purposes, is not capable of a practical steamboat, general merchandise navigation.

The drainage area of Salt River is four or five times as great as that of Pond River, and it supports a limited navigation from the mouth to the forks, a very short distance.

The principal forks of Kentucky River—the principal forks of the Licking River—drain, each and all of them, very much larger areas than does Pond River. In fact, it is a river only in name.

I have not made a survey or a personal examination of the river other than at its mouth, but I have the evidence of those who are familiar with its capacity, and that evidence is unfavorable.

* * * Green River is well improved and capable of an immense commerce, but there is no coal shipment on it, nor has there been for years of its existence; therefore there is absolutely no reason to think that mining of coal would profit by any work done on Pond River, or Creek, rather, and the logging interests can, as now, take advantage of high water and rafting be suspended during low water. I am, therefore, decidedly of the opinion that Pond River is not worthy of improvement.

Very respectfully, your obedient servant,

E. H. RUFFNER,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. Army.*
(Through the Division Engineer.)

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## H H 14.

## PRELIMINARY EXAMINATION OF SALT RIVER, KENTUCKY, FROM ITS MOUTH TO SHEPHERDSVILLE.

[Printed in House Doc. No. 203, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith report dated February 5, 1903, by Maj. Geo. McC. Derby, Corps of Engineers, on preliminary examination of Salt River, from its mouth to Shepherdsville, Ky., ordered by the river and harbor act of June 13, 1902. Major Derby considers the locality worthy of improvement by the General Government, and his report is forwarded by the division engineer, Col. G. J. Lydecker, Corps of Engineers, with favorable recommendation.

The Board of Engineers for Rivers and Harbors has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act. The locality has been visited and a public hearing has been held to afford interested parties an opportunity to express their views. The Board concludes, for reasons given in its report of May 21, 1903, that it is undesirable at this time to undertake this improvement, and in this conclusion I concur.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### REPORT OF MAJ. G. M'C. DERBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Louisville, Ky., February 5, 1903.*

GENERAL: I have the honor to submit the following report on the preliminary examination of Salt River, Kentucky, from its mouth to Shepherdsville.

An examination of this river, and a survey from its mouth to Pitts Point, were made in 1887, in compliance with the provisions of the river and harbor act of August 5, 1886; the report upon it is published in House Executive Document No. 184, Fiftieth Congress, first session. At that time Salt River was found worthy of improvement, and a project and estimate were submitted contemplating a lock and dam at Keys ripple to give navigation as far as Pitts Point, with a least depth of 5 feet, and for a distance of 3 miles farther up Salt River and 2 miles up Rolling Fork with a least depth of 2.5 feet.

The map of this survey is on file in this office, and serves the purpose of a preliminary examination from the mouth of the river to Pitts Point, a distance of 11.9 miles. The stretch of river from Shepherdsville to Pitts Point, about 12 miles, I traversed in a skiff at a stage of river about 2 feet above low water. The slope of this part of the river is quite steep, and rapids were crossed in two places. The banks are, however, high, and the situation seems generally favorable for slack-water navigation. It is probable that two locks and dams would be necessary to carry navigation to Shepherdsville, and any improvement that would enable vessels to pass the rapids at that point would also make available some 10 miles of navigable river extending above Shepherdsville.

Salt River flows through a rich agricultural country, and the town of Shepherdsville is the county seat of Bullitt County, and has a population of about 500 inhabitants. A small steamboat now navigates the river, ascending as far and as frequently as the stage of the river will permit, usually about 3 miles above Pitts Point. Some produce is also shipped out by barges. The present traffic on the river and the amount of commerce that will probably be benefited by its improvement are set forth in the two tables of statistics herewith, which were kindly furnished me by Mr. Charles Carroll, president of the Salt River Improvement Association.

I am of the opinion that Salt River from its mouth to Shepherdsville is worthy of improvement, and I would recommend that a survey and estimate be made to determine whether an adequate improvement can be made at a cost commensurate with the probable benefits to commerce. I would estimate the cost of such a survey at about $1,500.

Very respectfully, your obedient servant,

G. McC. DERBY,  
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,  
*Chief of Engineers, U. S. A.*  
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,  
*Cincinnati, Ohio, February 7, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in Major Derby's recommendation for the proposed survey.

G. J. LYDECKER,  
*Colonel, Corps of Engineers,*  
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,  
*February 14, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the river and harbor act of June 13, 1902.

A copy of House Executive Document No. 184, Fiftieth Congress, first session,[a] is herewith.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,  
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,  
*Washington, D. C., May 21, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report upon "Salt River, from its mouth to Shepherdsville," Ky., the indorsement of the division engineer thereon, and all other data available. A committee of the Board visited Shepherdsville, Ky., on April 4, 1903, and there gave opportunity, at a public hearing, for the expression of views by interested parties.

The improvement contemplated in the act directing the preliminary examination would require the construction of at least two locks and dams. The resulting waterway would traverse a rich farming country for about 24 miles, connecting Shepherdsville, Ky., a town of about 500 inhabitants, situated on the Louisville and Nashville Railway 18.1 miles from Louisville, with the Ohio River at a point about 25 miles below Louisville.

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[a] Not reprinted.

The commerce to be benefited is local in character and of insufficient volume to justify at this time the expenditure that canalization would involve. The result of slack-water improvement of a number of rivers in the same section of the country has not been uniformly encouraging, even when the original promise of commercial growth had been much greater than in the case of Salt River.

In case at some future time the general improvement of the Ohio River shall involve the construction of a dam below the mouth of Salt River, which would increase depths in the lower section of the latter, consideration may be given to an extension of the channel toward Shepherdsville.

The Board is of the opinion that it is undesirable at this time to undertake the improvement of "Salt River, from its mouth to Shepherdsville."

For the Board:

Chas. J. Allen,
*Lieut. Col., Corps of Engineers,*
*Senior Member of Board.*

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*Commerce to be benefited by the improvement of Salt River, Kentucky.*

| Articles. | Quantity. | Average price. | Value. |
|---|---|---|---|
| Hay ......tons.. | 20,000 | $10 per ton...... | $200,000 |
| Straw ......do.... | 10,000 | $5 per ton...... | 50,000 |
| Corn ......bushels.. | 100,000 | $0.35 per bushel ...... | 35,000 |
| Oats......do.... | 20,000 | $0.30 per bushel ...... | 6,000 |
| Wheat ......do.... | 60,000 | $0.70 per bushel ...... | 42,000 |
| Apples ......barrels.. | 25,000 | $1.50 per barrel...... | 37,500 |
| Potatoes ......do.... | 20,000 | $1 per barrel...... | 20,000 |
| Lime......do.... | 2,500 | $0.90 per barrel ...... | 2,250 |
| Cement ......do.... | 2,500 | $0.75 per barrel ...... | 1,875 |
| Salt ......do.... | 10,000 | $1.25 per barrel...... | 12,500 |
| Lumber ......feet.. | 5,000,000 | $10 per 1,000 feet...... | 50,000 |
| Hoop poles ...... | 2,000,000 | $7 per 1,000 ...... | 14,000 |
| Ties ...... | 50,000 | $0.30 each ...... | 15,000 |
| Tan bark ......cords.. | 3,000 | $9 per cord...... | 27,000 |
| Hogs ...... | 2,000 | $8 each ...... | 16,000 |
| Cattle ...... | 4,000 | $20 each ...... | 80,000 |
| Sheep...... | 10,000 | $3.50 each ...... | 35,000 |
| Turkeys ...... | 5,000 | $0.75 each ...... | 3,750 |
| Chickens ......dozen.. | 5,000 | $2.50 per dozen ...... | 12,500 |
| Eggs ......do.... | 50,000 | $0.12 per dozen ...... | 6,000 |
| Butter ......pounds.. | 30,000 | $0.15 per pound...... | 4,500 |
| Fertilizer......tons.. | 3,000 | $15 per ton...... | 45,000 |
| Coal......do.... | 10,000 | $2.75 per ton ...... | 27,500 |
| Tobacco ......hogsheads.. | 200 | $100 per hogshead .... | 20,000 |
| Total ...... | ...... | ...... | 763,375 |

*Commercial statistics of Salt River, Kentucky, for the year ending December 31, 1901.*
(*Approximated.*)

| Articles. | Quantity. | Average price. | Value. |
|---|---|---|---|
| Hay ........ tons.. | 4,000 | $10 per ton ........ | $40,000 |
| Corn ........ bushels.. | 20,000 | $0.35 per bushel ........ | 7,000 |
| Straw ........ tons.. | 2,000 | $5 per ton ........ | 10,000 |
| Oats ........ bushels.. | 5,000 | $0.30 per bushel ........ | 1,500 |
| Wheat ........ do.... | 20,000 | $0.70 per bushel ........ | 14,000 |
| Apples ........ barrels.. | 2,000 | $1.50 per barrel ........ | 3,000 |
| Potatoes ........ do.... | 3,000 | $1 per barrel ........ | 3,000 |
| Lime ........ do.... | 500 | $0.90 per barrel ........ | 450 |
| Cement ........ do.... | 500 | $0.75 per barrel ........ | 375 |
| Salt ........ do.... | 1,000 | $1.25 per barrel ........ | 1,250 |
| Lumber ........ feet.. | 1,000,000 | $10 per M feet ........ | 10,000 |
| Hoop poles ........ | 300,000 | $7 per M ........ | 2,100 |
| Ties ........ | 25,000 | $0.30 per tie ........ | 7,500 |
| Tan bark ........ tons.. | 1,500 | $9 per ton ........ | 13,500 |
| Hogs ........ | 500 | $8 per hog ........ | 4,000 |
| Cattle ........ | 1,000 | $20 each ........ | 20,000 |
| Sheep ........ | 1,000 | $3.50 each ........ | 3,500 |
| Turkeys ........ | 3,000 | $0.75 each ........ | 2,250 |
| Chickens ........ dozen.. | 1,000 | $2.50 per dozen ........ | 2,500 |
| Eggs ........ do.... | 10,000 | $0.12 per dozen ........ | 1,200 |
| Butter ........ pounds.. | 10,000 | $0.15 per pound ........ | 1,500 |
| Fertilizer ........ tons.... | 1,000 | $15 per ton ........ | 15,000 |
| Coal ........ do.... | 2,000 | $2.75 per ton ........ | 5,500 |
| Tobacco ........ hogsheads.. | 50 | $100 per hogshead ........ | 5,000 |
| Miscellaneous ........ | ........ | ........ | 50,000 |
| Total ........ | ........ | ........ | 224,125 |

## H H 15.

## PRELIMINARY EXAMINATION OF TRADEWATER RIVER, KENTUCKY.

[Printed in House Doc. No. 179, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 4, 1903.*

Sir: I have the honor to submit herewith report, dated July 25, 1902, by Maj. E. H. Ruffner, Corps of Engineers, on preliminary examination of Tradewater River, Kentucky, made in compliance with a requirement in the river and harbor act of June 13, 1902. In the opinion of Major Ruffner, concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, the locality is not worthy of improvement at this time by the General Government.

This report has been reviewed by the Board of Engineers for Rivers and Harbors, pursuant to the provisions of sections 3 and 14 of the above-mentioned act, and I concur in its opinion, as expressed in report dated April 1, 1903, that it is not desirable for the United States to undertake the further improvement of this river at the present time.

The sum of $16,500, appropriated by Congress between 1881 and 1888, has been applied to open-river regulation of this stream.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cincinnati, Ohio, July 25, 1902.*

GENERAL: Having been placed in charge of the preliminary examination, in accordance with circular letter, as provided for in the river and harbor act approved June 13, 1902, of the following locality, Tradewater River, Kentucky, the following is submitted:

* * * There was an examination and survey made of this river by Captain Cuyler in 1881, as reported in that report, pages 1991–1994. The survey is complete, and there is a profile of the river, and all engineering data necessary to make a beginning on any project approved by Congress, and for which an appropriation may be made.

After working upon the river from time to time during the interval 1881–1891 nothing permanent was attempted, and a second examination was made in 1896, and is found in the report for 1897, pages 2476–2183. D. A. Watt renders in full an account of the river, and Maj. Jas. F. Gregory reports "that the Tradewater River is not worthy of improvement by the General Government beyond the present approved project," which opinion was concurred in by the division engineer.

There has been no practical change in conditions in this vicinity since this last report was made.

The underlying thought is that there is coal, and good coal, on the river, and that it is mined and shipped by rail, and possibly might be shipped by river did facilities exist, and in this way compete with coal from the upper Ohio. This is all so, and there is a future to the region, when the time comes. The particular feature of the mouth of the Tradewater River is that the mines are near the Ohio, and have railroad facilities on that river now did they choose to take advantage thereof. Railroad shipment is secured, and apparently just now it does not pay to use the river. Then, the answer might be that the changes on the Ohio are too great to permit of its use at present. Since the floods that interfere on the greater river will also disturb the smaller, the only difference caused by putting in a lock and dam at the mouth of the Tradewater will be to make a small harbor there, which might or might not be used by the coal interests. Certainly the small harbor created, with limitations in the use of a lock, would only secure a small business at the best. There is no difference as to the estimated cost or facility of making the improvement suggested, were there funds available, developed in the prior reports, the sole question being the desirability of the improvement, and a doubt that there would be water enough in the river to permit much lockage. But if the subject is to be reviewed by me it will be simply another expression as to the commercial value of the proposed enterprise. While it might be bold to simply give an unsupported statement in the matter of probabilities there can be no objection to calling attention to existing facts.

Both the Tradewater and the Green rivers are in what is shown on the geological maps as the Carboniferous region of lower Kentucky. On both rivers are well-known and worked coal fields, and for many years the possibilities of development have been discussed and to some degree worked out. Coal is mined in quite large amounts on the Green River and sold on the river as well as shipped, and sold by rail. I am now preparing a table showing what is known of the different opened mines on the Green. This will be of value of itself; but it has a marked value on the question of the present value (not on the future value) of river shipments of coal in this region. It is evident that if this coal were enough developed now, or in the near future, or had been in the recent past to justify at least the attempt to mine and ship by river, the large area opened by the Green River would have shown some signs of this development. There the coal men do not have to await the slow action of the Government in locking and damming a river for their benefit; that has already been done—has been done for many years.

If it paid to mine and ship coal just now on the Green River, and business men thought it would pay, business men would mine and ship coal on the Green River. The river is in good shape and has been so for many years. The locks are not as long or as wide as might be, but they could serve a very large coal business before it were necessary to have larger or additional locks. The very long pools, and the great distance below Pittsburg, and the good climate all make the region fair to contemplate.

But the fact remains that there is no real coal business on Green River and there is none in sight, nor any prospect of increase.

It would seem that the former navigation company and the United States had made a full and fair experiment of development of this particular region, and that it is as yet too soon to see coal shipments occur.

The Green River is quite a different affair from the Tradewater and navigation is easy on it, the river being wide and straight enough for an easy coal traffic, and whatever objections were raised to the use of the smaller river for coal could not apply to the larger. Therefore, we have a support supplied by the Green River to the statement that just now commercial reasons do not seem to require any immediate action looking to the preparation of the Tradewater River for a coal business.

It is suggested that the coal companies at present interested on the river be permitted to build and operate a lock at the mouth of the river under the supervision of the United States, and that should coal traffic develop to justify the absorption by the United States provision might be made for reimbursing the company, as has been done in similar cases.

In my judgment, therefore, the improvement of the Tradewater River should not at the present time be undertaken by the United States, although it is quite possible that in future it might become necessary to build locks and dams on it, or to acquire those built by private parties. No further survey is necessary since full knowledge is had of the river and its characteristics.

Very respectfully, your obedient servant,

E. H. RUFFNER,
*Major of Engineers.*

Brig. Gen. GEO. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, August 2, 1902.*

Respectfully forwarded to the Chief of Engineers, U. S. Army.

I have no knowledge of the local conditions except that obtained from the within statement. From the facts presented by Major Ruffner, I concur in his opinion that the river is not at present worthy of improvement by the United States.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 13, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 1, 1903.*

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer, the indorsement of the division engineer thereon, several letters from interested parties, as well as reports of previous preliminary examinations, descriptions of work done on this river under a former project for its improvement, and all other data available.

The Tradewater River is in the same class with many others tributary to the Ohio River, in that an improvement of any character will be followed by an increase in the river trade. Many such rivers have been improved or are now under improvement, and the results of these improvements, even on streams which are larger than the Tradewater and had originally a similar or greater promise of success, have not been uniformly encouraging. In general, the benefit has not been sufficient to warrant undertaking new work unless there is a practical certainty of a growth of commerce commensurate with the cost.

In the case of the Tradewater River the general commerce is insufficient to warrant any large expenditure, and did not develop, under the former project for open-river regulation, to an extent justifying the continuance of such work. The only material commercial benefit to be hoped for is the development of the coal trade, which would require the construction of locks and dams, at an expense disproportionate to the probable benefits.

The Board is of the opinion that the present and prospective commerce of the Tradewater River is not sufficient to justify the immediate construction of locks and dams, and believes that it is not desirable for the United States to undertake further improvement of this river at the present time.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## H H 16.

## PRELIMINARY EXAMINATION OF WABASH RIVER ABOVE VINCENNES, TO PERRYSVILLE, INDIANA.

[Printed in House Doc. No. 196, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith for transmission to Congress a report dated September 19, 1903, by Maj. Geo. McC. Derby, Corps of Engineers, on preliminary examination of Wabash River above Vincennes to Perrysville, Ind., authorized by section 1 of the river and harbor act approved June 13, 1902.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and attention is respectfully invited to the Board's report of October 29, 1903, in third indorsement thereon.

This section of the Wabash River has been under improvement by the United States since 1882, and I concur in the opinion of the Board that it is not desirable for the United States at this time to continue the improvement of the river above Vincennes to Perrysville.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

## REPORT OF MAJ. G. M'C. DERBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Louisville, Ky., September 19, 1903.*

GENERAL: I have the honor to submit the following report on an examination of the Wabash River above Vincennes to Perrysville, in compliance with the requirements of the river and harbor act approved June 13, 1902.

The city of Vincennes, Ind., is situated on the Wabash River 124 miles from its mouth; Perrysville, Ind., is on the same river about 145 miles above Vincennes. The entire stretch of the river from Perrysville to its mouth, a distance of 269 miles, has been included in a project for improvement by the General Government ever since 1871; a large amount of money in the aggregate has been spent upon it, but in sums so inadequate in proportion to the difficulties to be encountered that no results have been obtained, either below Vincennes or above, such as would justify "the establishment of any considerable regular traffic" on the stream. There has never been any comprehensive, adequate plan for the improvement of this stream, which has never heretofore been surveyed continuously even from Vincennes to its mouth, all the work done on the river having been done from time to time, here and there, as local necessities and the limited funds available would permit. A thorough survey of the river below Vincennes, and the preparation of plans and estimates for the improvement of that part of the river, were ordered by Congress in the last river and harbor act, and this survey is now in progress.

A good survey of the river above Vincennes as far as Terre Haute is on file in this office, having been made during the low-water seasons from 1882 to 1884. There have been no material changes in this part of the river since, costly efforts at improvement having proven futile on account of the inadequacy of the scale on which the work was undertaken. This survey shows the Wabash above Vincennes to be a large stream, having a low-water discharge of considerable volume, a general low-water width of from 300 to 600 feet, and a moderate slope of only 48.9 feet in 90 miles; the channel is, however, very generally obstructed by bars of sand and gravel, with a low-water depth of less than 2 feet on them, and the bed is so full of dangerous snags that it has been estimated that it would cost not less than $5,000 per annum to merely keep the channel clear of snags. These snags make navigation so dangerous that the traffic on the river is merely nominal, even when the stream is sufficiently high to otherwise permit it. At Terre Haute there are several bridges that bar the passage above, but as yet there has been no traffic on the river that would justify requiring the owners of the bridges to maintain and operate draws, nor is there likely to be any such traffic in advance of a substantial improvement in the condition of the river.

The valley of the Wabash is a country rich in agricultural resources, and below Perrysville there is also mineral wealth in the shape of coal and fire clay which promises well for the more or less remote future. But an improvement of the river above Vincennes to Perrysville on such a scale as to make it of value to commerce would be an expensive undertaking which does not seem to be justifiable in advance of the improvement of the lower reaches of the river. There is practically no commerce above Vincennes at present, and an improvement above, in advance of one below, could hardly be expected to give rise to any.

For the above reasons I would not recommend at present a survey of the Wabash River above Vincennes to Perrysville. When the improvement of the river below Vincennes has made such progress as to result in the establishment of any considerable regular traffic on the river, the extension of the improvement above Vincennes to and above Terre Haute would probably be advisable.

Very respectfully, your obedient servant,

G. McC. DERBY,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, September 26, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the views expressed by the district engineer.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 3, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

Additional data have been requested from private parties.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 29, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer upon an examination of the "Wabash River above Vincennes to Perrysville," called for in section 1 of the river and harbor act of June 13, 1902, the indorsement of the division engineer thereon, and all other data available.

Vincennes, Ind., is situated on the Wabash River 124 miles above its mouth; Perrysville, Ind., is on the same river 145 miles above Vincennes. The Wabash River has been under improvement by the General Government since 1871. The improvement above Vincennes began in 1882, under a project for open-channel work, and has been carried on with more or less regularity to the present time. Up to June 30, 1902, the sum of $94,933.65 had been expended. The following references to this improvement in the Reports of the Chief of

Engineers seem to indicate that at no time have encouraging results from this improvement been apparent:

[1885] At present it is not deemed advisable that any more money should be expended on this portion of the river until the lock and dam at Grand Rapids is completed.

[1896] The channel is only available at high stages of water. At low water numerous bars, snags, and secondary channels render navigation, even with the lightest draft boats, extremely uncertain.

The report for 1902 repeats the last-mentioned statement and adds—

No regular line of steamboats operates upon this section of the river. The only traffic is carried on during high stages of water, when a few light-draft boats make irregular trips to transport corn, wheat, oats, and similar commodities to the nearest railway for shipment.

The district officer states in his report—

There is practically no commerce above Vincennes at present, and an improvement above, in advance of one below, could hardly be expected to give rise to any.

From the foregoing it will appear that the expenditure of the sum of $94,933.65 upon this stretch of river has resulted in no appreciable or permanent benefits.

The item of the river and harbor act calling for this report provides also for a survey and estimate of cost of improving "Wabash River below Vincennes, with a view to the necessities of commerce." Until the river has been improved below Vincennes to such an extent as to establish a considerable traffic any improvement above that point would be of little value and not commensurate with its cost.

In view of the foregoing the Board believes that it is not desirable for the United States at this time to continue the improvement of Wabash River above Vincennes to Perrysville.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## H H 17.

## SURVEY OF WABASH RIVER FROM VINCENNES, INDIANA, TO ITS MOUTH.

[Printed in House Doc. No. 568, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, February 24, 1904.*

SIR: I have the honor to submit herewith for transmission to Congress report of December 16, 1903, by Lieut. Harry Burgess, Corps of Engineers, on survey and estimate of the cost of improving Wabash River below Vincennes, Ind., authorized by section 1 of the river and harbor act approved June 13, 1902.

This portion of Wabash River has for many years been under improvement by the United States under projects which provided for regularization of the river channel by dredging, removal of obstructions, closing cut-offs, etc., together with the construction of a lock and dam at a point known as Grand Rapids.

In his consideration of the subject of the further improvement of the river, Lieutenant Burgess suggests two methods; first, by continuing the work of open-channel improvement, and second, by furnishing a complete system of slack-water navigation by locks and dams. Without slack water it is thought that it is not practicable to obtain a greater low-water depth than 4 feet, which, in his opinion, is not adequate. He therefore proposes to improve the river by the construction of locks and dams to give a slack-water navigation of 6 feet from the mouth to Vincennes. The estimated cost of the plan presented is $3,405,000, and, in the opinion of the local officer, the portion of the stream in question is worthy of improvement by the General Government in the manner and to the extent indicated.

In forwarding the report to this office, the division engineer, Col. G. J. Lydecker, Corps of Engineers, expresses his views in indorsement of December 30, 1903, as follows:

> After careful study of this report, and all other available data, it is my opinion that a lock and dam improvement of this part of the Wabash River at an estimated cost of three and a half million dollars, in round numbers, is not advisable until the commercial necessity for a constant navigable depth of 6 feet becomes much more apparent than it is at present. In the meantime an open-river improvement that would provide a 4-foot low-water channel could probably be made and maintained, by regular and systematic work, at an annual cost that would be but a very small percentage of the amount above indicated; and such a channel would be likely to serve all the commercial requirements of the Wabash River between its mouth and Vincennes for some years to come, or until a radical improvement of the lower Ohio is effected.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in section 3 of the act of June 13, 1902, and attention is respectfully invited to the Board's report of February 9, 1904, in a separate paper herewith.

After a review of the present condition of the slack-water improvement of the Ohio River and its tributaries, and a statement of the probable cost of completion of the works already projected on those streams, the Board considers that the plan to be ultimately adopted for the Ohio River improvement has influence upon the adoption of any plan of improvement for the Wabash, and concludes by saying that—

> When the improvement of the Wabash is undertaken, as it probably will be at some future time, the work can be made to conform to the conditions then prevailing in the Ohio River. In the opinion of the Board, it is not advisable at the present time to undertake the further improvement of Wabash River below Vincennes.

I concur in the views of the Board.

Very respectfully, your obedient servant,

A. MACKENZIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. WM. H. TAFT,
*Secretary of War.*

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## REPORT OF LIEUT. H. BURGESS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Louisville, Ky., December 16, 1903.*

GENERAL: I have the honor to make the following report upon a survey of the Wabash River from Vincennes to the mouth, in accordance with the approved project for the application of funds provided by the river and harbor act of June 13, 1902:

The Wabash River below Vincennes lies between the States of Indiana and Illinois, the distance by river from Vincennes to the mouth being 126.38 miles, midstream measurement. The Wabash empties into the Ohio River 55.25 miles below Evansville, Ind.

The item of the river and harbor act approved June 13, 1902, referred to, is as follows:

> Improving Wabash River, Indiana and Illinois, below Vincennes: Continuing improvement, five thousand dollars; which amount, together with the unexpended balance of any appropriations heretofore made for the improvement of said river, or so much thereof as may be necessary, may be expended in making a survey and estimate of the cost of improving said Wabash River below Vincennes, with a view to the necessities of commerce, and in making a proper examination of the Wabash River above Vincennes to Perrysville [a], also of the Little Wabash River to Carmi [b]. In case, on such preliminary examination favorable reports shall be made the Secretary of War may in his discretion direct detailed surveys of the same to be made.

The funds combined and made available under this act amounted to $20,912.74.

The Report of the Chief of Engineers for 1879, pages 1450 to 1453, contains a history of the surveys of this river and of the work of improvement done on the river to that time. The Reports for 1896, pages 2239 to 2241, and for 1898, pages 1970 to 1987, contain statements of the original project, condition of works at dates of reports, and other information in regard to the river. In 1882–1884 a survey was made from Terre Haute to Mount Carmel. Other surveys of special localities where work was contemplated have been made from time to time.

The data on file from surveys heretofore made, were insufficient for the preparation of a plan for the systematic improvement of the river, for which reason the district engineer officer in his annual report for 1901 recommended that a detailed survey be made of the river from Vincennes to the mouth. Such a survey was authorized by the act of Congress quoted above.

A survey party was organized in November, 1902, in charge of Mr. S. F. Crecelius, assistant engineer. This party consisted of the assistant engineer, 1 transitman, 1 leveler, 2 recorders, and 6 to 10 laborers. Fieldwork was begun on November 10 and was continued to December 24, 1902, when it became necessary to suspend work on account of high water. Fieldwork was resumed on May 7, 1903, and continued until August 7, 1903, when it was again suspended on account of the sinking of the quarter boat. This accident delayed the work, but the fieldwork to the foot of the New Harmony Cut-off was completed on September 8, 1903.

To enable Mr. Crecelius to work up his notes and make report on this part of the river he was replaced in charge of the field party by Mr. Thomas P. Shanks, assistant engineer. A draftsman was also attached to the party. The party thus organized resumed the survey at the foot of the New Harmony Cut-off on September 13, 1903, and continued until November 28, 1903, when all fieldwork was finished. The notes of the entire survey have been platted (in pencil) on 65 sheets, on a scale of 200 feet to the inch. A profile showing bottom, low-water surface, and banks has also been prepared.

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[a] Report printed in House Doc. No. 196, 58th Congress, 2d session.

[b] Report printed in House Doc. No. 38, 58th Congress, 2d session.

### CHARACTERISTICS OF THE COUNTRY.

The valley of the Wabash is essentially an agricultural district. The valley is gently undulating, the undulations limiting the extreme high water, although in places large areas are submerged by the extreme high water. From Vincennes to the mouth the counties of Knox, Gibson, and Posey in Indiana, and Lawrence, Wabash, White, and Gallatin in Illinois, are adjacent to the river, the country being rich farming land. During the last few years there has been a marked increase in the manufacturing interests in this district, due in a large measure to the presence of coal veins in all of the above Indiana counties, including several large areas of "block" coal. The chief resources of the country, however, are the agricultural products. The Baltimore and Ohio Southwestern Railroad crosses the river at Vincennes, the Big Four at St. Francisville, the Southern Railway at Mount Carmel, the Illinois Central at Grayville, and the Louisville and Nashville below Grand Chain. The Big Four has a line which practically parallels the river below Vincennes.

The principal tributary of the Wabash is the White River, which flows in a generally southwesterly direction through Indiana and joins the Wabash just above Mount Carmel. This river is navigable for only a few miles above its mouth. The Little Wabash enters the Wabash about 15 miles above the mouth of the latter. This stream lies in Illinois, and, while navigable for only a few miles above its mouth, serves as the outlet for large quantities of corn and wheat when the Wabash is navigable for a 6 to 8 foot depth. The upper Wabash, above Vincennes, is regarded as a navigable stream as far up as Lafayette, which is 197 miles above Vincennes. If the lower river is improved there will undoubtedly be a large increase in the commerce of the upper river, certainly as far up as Terre Haute—215 miles from the mouth of the river.

The principal towns from Vincennes down and their population are: Vincennes, Ind., 10,249; St. Francisville, Ill., 591; Mount Carmel, Ill., 4,311; Grayville, Ill., 1,948, and New Harmony, Ind., 1,341. These figures are taken from the census of 1900.

Transportation is now almost exclusively by railroad, the river traffic being limited to the short seasons of high water. Above Vincennes small boats ply at medium stages, but, by reason of snags and bars, are laid up during low water.

### CHARACTERISTICS OF THE RIVER.

The lower Wabash is wide and shallow, obstructed by sand and gravel bars, and in a few cases by rock reefs. The usual width of the river is about 1,000 feet, but 1,200 to 1,400 is not uncommon. The banks are low, especially from Vincennes to St. Francisville, about 13 miles, on which stretch levees are required to prevent overflow from ordinary high water. The banks are generally a soft loamy material, easily moved by the current; caving banks are therefore frequent. Much standing timber remains on the banks and enters the river with the slides, forming dangerous snags. The bottom of the river is generally sand or gravel, but, beginning about 1,000 feet below Little Chain, there are occasional outcrops of rock all the way to Vincennes. These rock reefs form the most serious obstructions to navigation. At Little Chain and Grand Chain a large amount of work has been done by the United States, but these places are still difficult of passage.

In the original condition of the river Grand Rapids was by far the most serious obstruction, but a lock and dam have been constructed there, so that boats can pass this place at all times. Near New Harmony the river has formed a cut-off, which takes very nearly the whole low-water discharge of the river, leaving only a few inches depth in the original channel. The cut-off itself can not be safely navigated on account of the swift current. This cut-off was closed in 1875–76, but the river has cut around the head of the dam, rendering that work of no value. In 1898 a project was submitted and approved for closing this cut-off, but the appropriations since that time have been insufficient to begin the construction. At present this is the most serious obstruction on the river. Other prominent obstructions where work has been done in the past are: Warwicks Ripple, a rock reef 38 miles from mouth; Coffee Island Chute, a rock reef 87.5 miles from mouth; White River shoals, a wide rock reef at the mouth of White River; Nine-mile Ripple, a rock reef about 9 miles from Vincennes.

The total fall of the river from Vincennes to the mouth is 83.53 feet, the distance being 126.38 miles. From Vincennes to the crest of the Grand Rapids dam the fall is 11.32 feet, and from the foot of the dam to the mouth of the river the fall is 60.41 feet. The depth of water on the Grand Rapids dam at the lowest gauge reading of record is 0.32 foot. This gives a calculated low-water discharge of 660 cubic feet per second. With 10 feet on the dam, i. e., water at level of lock walls, the calculated discharge is 122,000 cubic feet per second. The highest water recorded here was in 1875, when the water was 28.6 above low water.

Between Vincennes and the mouth there are the following bridges: (1) Baltimore and Ohio Southwestern Railroad bridge at Vincennes, iron, with drawspan; (2) wagon bridge at Vincennes, iron, with drawspan; (3) Big Four bridge near St. Francisville, wood and iron, with drawspan; (4) Southern Railway bridge at Mount Carmel, iron, with drawspan; (5) Illinois Central Railroad bridge near Grayville, iron, with drawspan; (6) Louisville and Nashville Railroad bridge near Grand Chain, iron, with drawspan.

## METHOD OF IMPROVEMENT PROPOSED.

Since the United States undertook the improvement of this river, the method followed has been that of regularization, except for the construction of the lock and dam to pass the Grand Rapids; channels were cut through some of the rock reefs, cut-offs were closed, banks protected, channels dredged through sand and gravel bars, and wing dams constructed to narrow the channel. While the work done in this way undoubtedly temporarily improved the condition of the river and made low-water navigation possible, there has been no permanent improvement in the river, except for the lock and dam at Grand Rapids. To keep the river open to navigation at all seasons by the methods heretofore used will require continuous large annual appropriations. When the appropriations are discontinued for several consecutive years, there will almost certainly be a failure in low-water navigation. Under such uncertain conditions there can be no extensive development in river navigation. Expensive boats can not be constructed where there is a probability that for the low-water season for several years they can not be used. For these reasons it is believed that slack water will give the only satisfactory improvement possible for this river. Such an improvement will be permanent and will require a relatively small annual expenditure for operation and maintenance.

Another great advantage of slack-water navigation is the greater depth that can be obtained. Without slack water it is thought that a greater low-water depth than 4 feet can not be obtained. The improvement of the Wabash is desired to a large extent to aid in the development of the Indiana coal fields. It is especially true in the water transport of coal that from an economical standpoint the depth should be at least 6 feet. It is also undoubtedly true of other freight that greater depth means more economical transport. For these reasons it is proposed to improve this river by the construction of locks and dams to give a slack-water navigation of 6 feet from the mouth to Vincennes. The great width of the Wabash, requiring long dams, and the low banks, making necessary more locks of small lift instead of fewer locks of great lift, make slack-water navigation for this river very expensive. In spite of this, however, I believe that slack-water navigation is the only satisfactory improvement possible for the lower Wabash.

The locks and abutments are to be of concrete, the lock having an available length of 214 feet and width of 52 feet. Where not resting on rock the locks and abutments are to have pile foundations. The dams when resting on rock are to be of concrete. When founded on sand or gravel the dam is to be a rock-filled pile substructure, extending to within 1 foot of the surface of the lower pool, and a superstructure of concrete. The following table gives the numbers of the locks, their location, the estimated cost, and other data:

| Number of lock. | Miles from mouth, measured on channel line (taken from profile sheet). | At or near— | Foundation. | Lift. | Length of dam. | Height of dam. | Cost of lock and dam. |
|---|---|---|---|---|---|---|---|
| | | | | *Feet.* | *Feet.* | *Feet.* | |
| 1 | 1.56 | Mouth | Sand or gravel | 8 to 9 | 1,000 | 15 | $308,466 |
| 2 | 8.35 | MacKeys Island | do | 7 | 1,000 | 15 | 305,972 |
| 3 | 18.29 | | do | 7 | 1,200 | 12 | 298,342 |
| 4 | 26.27 | Little Chain | Rock | 7 | 1,000 | 13 | 225,966 |
| 5 | 39.06 | Twin Sister Island | do | 8 | 1,100 | 15 | 250,138 |
| 6 | 54.82 | Juno Island | Sand or gravel | 7.5 | 1,150 | 15 | 326,790 |
| 7 | 62.60 | | do | 7.5 | 1,200 | 15 | 332,612 |
| 8 | 84.92 | | do | 8.5 | 1,050 | 16 | 328,841 |
| [a] 9 | 100.13 | Grand Rapids | Rock | 10.5 | | | 5,000 |
| 10 | 106.17 | | do | 7 | 1,000 | 14 | 243,364 |
| 11 | 122.45 | Pork Island | do | 7 | 800 | 11 | 230,010 |
| | | Total | | | | | 2,855,501 |

[a] No. 9 is the existing lock at Grand Rapids; the dam requires to be raised 1 foot to give 6 feet on upper miter sill.

The location given for the proposed locks is in no case intended to be exact, the data given by the survey not being sufficient for an exact location. Where possible, locks and dams were so located that they would rest on rock; only Nos. 4, 5, 10, and 11, however, are so located.

It is possible that borings may show rock at the sites of several of the other locks, in which case the cost will be less than that estimated. The location of Lock No. 1 is largely determined by the character of the banks, which are more favorable at the place proposed than for several miles upstream. Before a 6-foot depth in the Wabash will be of full value, the Ohio River must also have a 6-foot, low-water depth; a depth at least as great as 6 feet is only a question of time. The miter sill of No. 1 is, however, placed at 309 without regard to what the future low-water level may be in the Ohio at the mouth of the Wabash. Should this level be raised before the construction of Lock No. 1 is commenced, the lower miter sill of that lock may be raised and the lock walls be constructed of less height than estimated for.

In addition to the construction of locks and dams, there is required some dredging and rock excavation, snagging, closing the mouth of Old River, and closing Little Chain Cut-off. Lock No. 4 was so located as to render unnecessary the closing of the New Harmony Cut-off. The rock excavation is small, being only 16,000 cubic yards for a lower approach to Lock No. 4. The estimated original dredging required is about 180,000 cubic yards; but cuts made through bars will undoubtedly fill more or less every year, as also the approaches to the locks. In addition, slides will occur, forming obstructions which must be removed by dredging. A dredge, therefore, will be necessary to do the dredging required after the annual high water. This dredge should be provided for in the first appropriation, so that the dredging may go on simultaneously with the construction of the locks and dams. This is also true of the snag boat, which must be provided to remove the snags which are now in the river, and to be operated every year to remove new snags brought down from the upper river or the tributaries, or forming from the caving banks. Scows must also be provided. The cost of the snag boat, dredge, and scows is estimated together. The mouth of Old River is to be closed by a levee which will be about 2,000 feet long and will contain about 11,250 cubic yards of earth. Little Chain Cut-off is to be closed by a 700-foot rock-filled crib dam.

It is probable that the construction of pools will cause some claims for flooding lands. The height of dams has been made small to prevent any extensive flooding; but at stages of the water which give 4 to 10 feet depth on the dams, small areas will be under water which at similar stages of the unobstructed river would be out of water. As nearly as can be ascertained these areas will be small. It is possible that a few low levees may wholly prevent such flooding. At the high-water stages the dams will have little effect on the width of the river. As the limits of the survey do not include sufficient data to determine the areas which may be flooded, no estimate is submitted to cover the damages which may be caused thereby.

*Summary of cost.*

| | |
|---|---|
| Locks and dams | $2,855,500 |
| Closing Little Chain Cut-off | 34,000 |
| Closing mouth of Old River | 25,000 |
| Dredging and snagging plant | 110,000 |
| Dredging | 23,000 |
| Rock excavation | 35,000 |
| Snagging and clearing banks | 13,500 |
| Contingencies, 10 per cent | 309,000 |
| Total | 3,405,000 |

No exact estimate of the probable benefit to commerce of the improvement proposed can be arrived at. The average annual tonnage passing the Grand Rapids lock in the past seven years is only 3,114 tons. The average annual tonnage for the six years, 1887 to 1892, for the lower Wabash was 102,275 tons, there being a marked falling off after 1892, when low-water navigation was practically stopped by the New Harmony Cut-off re-forming around the head of the closing dam. The Wabash Improvement Association, of which Mr. Frank O. Fitton, of New Harmony, Ind., is president, has collected a large amount of statistics of the agricultural and mineral resources of the counties of Indiana and Illinois bordering on the Wabash. From the report[a] of this association the statistics below are taken, except as otherwise noted. This report is now in the hands of the printer, and a copy will be sent as an appendix to this report if received in time. The ten Indiana counties, and the six Illinois counties bordering on the Wabash below Lafayette have an annual production as follows (year 1901):

| | | |
|---|---|---|
| Wheat | bushels.. | 5,071,309 |
| Corn | do.... | 32,664,916 |
| Oats | do.... | 5,032,542 |
| Hay | tons.. | 609,522 |
| Potatoes | bushels.. | 638,274 |
| Straw | tons.. | 152,000 |
| Wool | pounds.. | 436,619 |

In the same counties the aggregate area of farms is 3,847,753 acres, the total valuation of farms and live stock being $173,273,613. The annual value of farm products not fed to stock is (1901) $27,951,836.

The 10 Indiana counties are all in the Indiana coal belt, the total area of coal land being 3,805 square miles and the areas of workable coal being 1,705 square miles. The estimated amount of workable coal not yet removed is 6,151,500,000 tons. The report of the Indiana department of statistics for 1901-2 gives 2,476,415 tons for the actual output of coal in 1901 for 6 of these counties, viz, Gibson, Knox, Parke, Sullivan, Vermilion, and Vigo, statistics for the other counties of Indiana and for the Illinois counties not being available.

The extensive areas of timber which at one time nearly covered the valley of the Wabash have practically disappeared, but there is still some timber remaining. In 1901 in the 10 Indiana counties there were 96,500 acres of timber. This is relatively small, and the timber movement on the river can not become of any great moment.

The agricultural products of this valley are very extensive, and it is believed that the improvement of the Wabash will cause a large percentage of these products to abandon rail transport in favor of the cheaper water transportation. It is also thought that the improvement will cause a great and immediate development of the coal-mining industry.

In view of the actual agricultural production and the probable coal output which will have the benefit of the cheaper freight rates, I am of the opinion that the Wabash River is worthy of improvement by the General Government from the mouth to Vincennes for a navigable depth of 6 feet, by the methods and at the cost heretofore set forth.

It has been impossible to finish the maps[a] of the survey in time to accompany this report. If desired, they can be sent later. There is sent herewith a profile[a] showing the bottom, banks, low-water slopes, location of proposed locks and dams, and the limits of the pools. There is also inclosed a map[a] prepared by the Wabash River Improvement Association.

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[a] Not printed.

Very respectfully, your obedient servant,

H. BURGESS,
*First Lieutenant, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, December 30, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

After careful study of this report, and all other available data, it is my opinion that a lock and dam improvement of this part of the Wabash River at an estimated cost of $3,500,000, in round numbers, is not advisable until the commercial necessity for a constant navigable depth of 6 feet becomes much more apparent than it is at present. In the meantime, an open-river improvement that would provide a 4-foot low-water channel could probably be made and maintained, by regular and systematic work, at an annual cost that would be but a very small percentage of the amount above indicated; and such a channel would be likely to serve all the commercial requirements of the Wabash River between its mouth and Vincennes for some years to come, or until a radical improvement of the lower Ohio is effected.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

[Second indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, January 5, 1904.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for examination and review.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., February 9, 1904.*

Respectfully returned to the Chief of Engineers, United States Army, inviting attention to report of this date.

For the Board:

A. M. MILLER,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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[a] Not printed.

## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

The Board of Engineers for Rivers and Harbors,
*Washington, D. C., February 9, 1904.*

General: Inviting attention to indorsement of this date returning to the Chief of Engineers a report submitted in compliance with the river and harbor act of June 13, 1902, by Lieut. Harry Burgess, Corps of Engineers, on a survey and estimate of cost of improving Wabash River below Vincennes, the Board of Engineers for Rivers and Harbors has the honor to submit the following report:

The Board has reviewed the report of the district officer and has considered the indorsement of the division engineer thereon and other data available. On January 23, 1904, there was held at Vincennes, Ind., by a committee of the Board, a duly advertised public hearing at which interested parties were given opportunity to be heard, and at which written arguments were presented for record.

The Wabash has been under improvement by the United States since 1872. The original project contemplated the improvement of the river by open-channel work from Lafayette to the mouth, a distance of 322 miles. Since 1881 separate appropriations have been made for "work above Vincennes" and "work below Vincennes." Appropriations and allotments have been as follows:

| | |
|---|---|
| Lafayette to mouth | $330,500.00 |
| Above Vincennes | 95,500.00 |
| Below Vincennes | 385,000.00 |
| Operation and care of lock and dam at Grand Rapids | 21,425.55 |
| Total | 832,425.55 |

The existing project for work below Vincennes is for "open-channel work and construction of lock and dam at Grand Rapids," but since 1884 there has been very little open-channel work, as nearly all available funds were applied to the construction of the lock and dam. This lock and dam is located 2.5 miles above Mount Carmel, Ill., and 100.1 miles, channel measurement, above the mouth of the Wabash River. It was built by the United States and completed in 1894. The distance from Vincennes to the mouth of the river is 131.8 miles, channel measurement, and 126.38 miles, midstream measurement, the fall being 83 feet, or 0.66 foot per mile.

Through navigation at low water is now impracticable. Boats drawing 20 inches can pass from Mount Carmel to Vincennes, a distance of about 32 miles, at all stages, but can only reach Mount Carmel from below for about three months in the year when the gauge at the lock reads 7.5 feet or more. In addition to the construction of the lock and dam at Grand Rapids, channels have been cut through some of the rocky reefs, cut-offs closed, banks protected, channels dredged through sand and gravel bars, and wing dams constructed to narrow and deepen the channel. While this work was of temporary benefit to navigation no permanent improvement of the river, except locally by means of the lock and dam, has been effected. It is the opinion of the Board that to secure most economically a suitable navigable depth at low water, a continuous slack-water improvement must be effected.

The district officer submits a project for a 6-foot slack-water improvement, which provides for 11 locks and dams, including the one now at Grand Rapids, and certain dredging and rock excavation, at a total estimated cost of $3,405,000.

The present commerce of Wabash River is small. The average annual tonnage passing the Grand Rapids lock for the past 7 years is 3,114 tons. As in all such problems, the amount of commerce that would take advantage of the proposed improvement can not be estimated with any degree of certainty.

The coal field of Indiana is in the southwestern corner of the State bordering the Wabash from its mouth to Warren County, a distance of more than 300 miles. In 1901 the total production of coal in this field, as reported by the Geological Survey, was 6,918,225 tons, and the State mine inspector reports the total production in 1902 as 8,311,381 tons. Of the amount mined in 1902, 4,715,916 tons were from counties directly on Wabash River, and 2,254,597 tons were from counties on White River, the principal tributary of the Wabash. In the past five years the coal production of Indiana has doubled.

The present market for Indiana coal is Chicago and vicinity, Indianapolis, and the various manufacturing towns that have sprung up in and near the coal field itself, and in what is still known as the gas belt of Indiana. The reduction in the quantity of gas now available has caused the migration to southwestern Indiana of many manufacturing plants seeking cheap fuel. There is evidence of this migration both at Evansville and Vincennes.

The counties of Illinois bordering Indiana are also underlaid with coal, but the Geological Survey reports the output of only one such county, Vermilion, which produced 2,260,964 tons in 1901.

What the coal production and the manufactures of the Wabash Valley will be ten years hence, when the completion might be expected of any system of improvement if work were now inaugurated, is a mattei of speculation, but the present growth is certainly very rapid.

Agriculturally, the Wabash Valley has already reached a high state of development. The three counties of Indiana bordering upon the Wabash at and below Vincennes produce annually 7,063,000 bushels of corn and 2,995,293 bushels of wheat. The annual production of the corresponding counties in Illinois is 5,231,344 bushels of corn and 1,165,067 bushels of wheat.

An improved channel in the Wabash River would serve to transport to railroad points most of the agricultural products grown within several miles of its banks. By means of packets a large part of the jobbing business would be conducted between towns on the Wabash and Ohio rivers. Some of the raw materials of manufacture, such as straw and lumber, would be barged upon the river. But the most promising item of transportation would be coal. Below Vincennes, and near the river, coal operations have been less extensive than in the river counties farther north. It is not certain that for many years the coal along the Wabash, below Vincennes, could compete in southern markets, reached via the Ohio and Mississippi rivers, with coal from the upper tributaries of the Ohio.

It seems more probable that the coal higher up the Wabash which has been more generally developed could be successfully marketed south. The slope of the river immediately above Vincennes is less than the slope below, and the improvement for some distance above Vincennes would probably cost less per mile than would the portion undei present consideration. For these reasons the Board believes that the project under review should be considered as but a part of a logically complete plan for the improvement of the Wabash, and that such an improvement, which should be undertaken if the work is inaugurated, would cost not less than $6,000,000 to $8,000,000 for a 6-foot channel, depending upon the upper limit of the improvement.

It seems opportune in this connection to review the state of the works of improvement projected for the Ohio River and its tributaries.

Between Pittsburg and the mouth of the Big Miami on the Ohio River 2 locks and dams have been constructed, expenditures have been authorized in the case of 11 more, and surveys and estimates are before Congress for 25 additional locks and dams. To complete the work in this section of the Ohio River will cost almost $40,000,000, and the annual expense of maintenance and operation of the resulting slack-water system will approach $1,000,000. At Louisville a canal with 2 locks has been built to surmount the Falls of the Ohio.

Upon the Allegheny and Monongahela 18 locks and dams have been built or definitely authorized. Of the locks and dams upon the Monongahela 1 is being reconstructed and 4 locks and dams from among those purchased from the original corporation which improved the lower stretch of this river are in urgent need of rebuilding at great expense. The natural corollary of the work already authorized upon the Allegheny would be the extension of the improvement by other locks and dams not yet provided for.

Upon the Little Kanawha the United States has built 1 lock and dam, has given consideration to the purchase of 4 owned by a private company and located between the Government lock and the mouth of the river, and further consideration may be expected of an extension of this system higher up the river into the coal field.

Upon the Muskingum 10 locks and dams, ceded to the United States by the State of Ohio and largely rebuilt, are being operated by the United States. It is doubtful whether this improvement may profitably be extended much farther up the river.

The Kanawha has 10 locks and dams built and operated by the United States. No future extension of this improvement is probable.

Upon the Big Sandy and its forks 1 lock and dam have been built, expenditures have been authorized upon 4 others, and 17 additional will be required to complete the improvement.

Upon the Kentucky River 9 locks have been built, expenditures have been authorized upon 3 more, and 2 additonal will be needed.

Upon the Green, Barren, and Rough rivers 7 locks have been built, 1 additional is authorized, and the construction of no others need be expected.

Upon the Wabash 1 lock has been completed as described heretofore in this report.

The Cumberland River has 8 locks under construction and 28 additional locks projected. Expenditures have been authorized upon 9 of the latter.

Upon the Tennessee 11 locks have been built and 4 additional will be needed to complete the system. Expenditures have been authorized upon 2 of the 4 last mentioned.

Thus it is seen that upon the Ohio and its tributaries 74 locks have been built, 40 additional locks have been authorized, and 65 may be regarded as projected, with no funds yet available for their construction. Upon the Allegheny, Little Kanawha, and the Wabash, in addition to the work already projected or completed upon these rivers, there may be expected in the future new projects for from 30 to 40 locks and dams. Furthermore, it can not be ignored that the extension of the slack-water improvement on the Ohio from the mouth of the Big Miami to Cairo will, in time, receive consideration, and possibly the project depth will be increased to 9 feet from Pittsburg to Cairo.

Ignoring work upon the Ohio below the Big Miami, and upon the Allegheny, Little Kanawha, and Wabash, in extension of work already projected, it may be roughly estimated that the completion of the works above described upon the Ohio and its tributaries will cost from $65,000,000 to $75,000,000, and that the operation and care of the works will subsequently cost about $2,000,000 annually.

Available depths in the Ohio River above and below the mouth of the Wabash are less than 6 feet for large portions of the year. Work upon a 6-foot slack-water system is progressing from Pittsburg to a point near the Ohio-Indiana boundary line. Whether the project depth in the Ohio will be increased to 9 feet, and whether the entire river will be slack-watered, are questions which can not now be answered. But if these matters are determined affirmatively, it is obvious that they bear upon the proposed improvement of the Wabash in several ways. The complete canalization of the Ohio to 9 feet might well be expected to cost from $70,000,000 to $80,000,000, and the undertaking of this work would tend to postpone the undertaking of subsidiary projects. It would be but logical, if it be determined to improve the Ohio throughout, that this river, being the trunk, should be completed before work is begun on tributaries other than those now approaching completion, or at least approaching a useful state. When the improvement of the Wabash is undertaken, as it probably will be at some future time, the work can be made to conform to the conditions then prevailing in the Ohio River.

In the opinion of the Board, it is not advisable at the present time to undertake the further improvement of Wabash River below Vincennes.

Respectfully submitted.

A. M. Miller,
*Lieut. Col., Corps of Engineers.*
R. L. Hoxie,
*Major, Corps of Engineers.*
H. C. Newcomer,
*Captain, Corps of Engineers.*
W. V. Judson,
*Captain, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

# APPENDIX I I.

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## IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

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*REPORT OF CAPT. CHAS. L. POTTER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. **Harbor at Grand Marais, Minnesota.**
2. **Harbor at Agate Bay, Minnesota.**
3. **Harbor at Duluth, Minnesota, and Superior, Wisconsin.**
4. **Harbor at Port Wing, Wisconsin.**
5. **Harbor at Ashland, Wisconsin.**
6. **Harbor at Ontonagon, Michigan.**
7. **Waterway from Keweenaw Bay to Lake Superior, Michigan.**
8. **Harbor at Marquette, Michigan.**
9. **Harbor of refuge, Marquette Bay, Michigan.**
10. **Harbor of refuge, at Grand Marais, Michigan.**
11. **Removing sunken vessels or craft obstructing or endangering navigation.**

### EXAMINATIONS AND SURVEY.

12. Grand Marais Harbor, Minnesota.
13. Marquette Harbor, Michigan.
14. Ontonagon Harbor, Michigan.
15. Bay at mouth of Split Rock River, Minnesota.
16. St. Louis River, Minnesota.

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UNITED STATES ENGINEER OFFICE,
*Duluth, Minn., July 23, 1904.*

GENERAL: In compliance with General Orders, No. 3, War Department, Office of the Chief of Engineers, Washington, April 25, 1904, I have the honor to transmit herewith my annual report of the works under my charge in the Duluth, Minn., district.

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Very respectfully,

CHAS. L. POTTER,
*Captain, Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

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# I I I.

## IMPROVEMENT OF HARBOR AT GRAND MARAIS, MINNESOTA.

The object of the improvement is to provide a harbor for purposes of refuge and for commerce.

For a description of the harbor and of operations prior to June 30, 1903, see Report of the Chief of Engineers, United States Army, for the respective years. A small map of the harbor accompanies the report for 1903.

The work done at this harbor during the past fiscal year consisted of repairs to the deck of the east breakwater, necessitated by a southwest gale which occurred September 12–13, 1903. This gale was the most severe one in the recollection of the inhabitants. It destroyed the deck plank from an area of about 30 by 70 feet and washed out 12 or 15 cords of rock filling. The plank was 3 inches thick, old and considerably decayed. Repairs were made in October, 1903. The westerly 168 linear feet of the breakwater was relaid with heavier plank, 6 inches thick, and 17 cords of rock were placed in the pier. The cost of these repairs was about $1,168.

The available balance and additional appropriation recommended will be applied to the maintenance of the work.

The village of Grand Marais has, during the last two or three years, experienced a marked increase in population and general business, as evidenced by the construction of a new hotel, several stores, a bank, a new school building, church, many residences, and during the past winter and spring a sawmill has been built on the west shore of the harbor.

For the results of a preliminary survey of this harbor "with a view to ascertaining the necessity of making any change in or addition to the east pier" see House Document No. 213, Fifty-eighth Congress, second session; also the current summary.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,056.07 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 1,739.66 |
| July 1, 1904, balance unexpended | 316.41 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 2,000.00 |

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT GRAND MARAIS, MINN.

| By act of Congress— | | By act of Congress— | |
|---|---|---|---|
| Approved March 1, 1879 | $10,000 | Approved July 13, 1892 | $10,000 |
| Approved June 14, 1880 | 10,000 | Of August 18, 1894 | 3,000 |
| Approved March 3, 1881 | 20,000 | June 3, 1896 | 3,000 |
| Passed August 2, 1882 | 20,000 | March 3, 1899 | 30,000 |
| Approved July 5, 1884 | 10,000 | Approved June 13, 1902 | 2,000 |
| Approved August 5, 1886 | 10,000 | | |
| Passed August 11, 1888 | 15,000 | Total | 165,350 |
| Approved September 19, 1890 | 22,350 | | |

COMMERCIAL STATISTICS.

*Arrivals and clearances of vessels at Grand Marais, Minn., for calendar year 1903.*

| Designation. | Arrivals. | Clearances. | Total. |
|---|---|---|---|
| Coastwise | 275 | 275 | 550 |
| Foreign | 255 | 255 | 510 |
| Total | 530 | 530 | 1,060 |

Estimated net registered tonnage, 371,000.

*Freight received and shipped, 1903.*

[In tons of 2,000 pounds.]

| | |
|---|---|
| **Receipts:** | |
| Meats | 88 |
| Flour and mill stuff | 1,011 |
| Grain | 334 |
| Coal | 55 |
| Miscellaneous merchandise | 1,073 |
| Lumber, brick, and shingles | 1,542 |
| Live stock | 60 |
| Engine, mill machinery, and iron | 169 |
| Total | 4,332 |
| **Shipments:** | |
| Railroad ties and telegraph poles | 27,792 |
| Lumber and square timber | 763 |
| Miscellaneous merchandise | 391 |
| Fish | 77 |
| Pulp wood | 1,900 |
| Total | 30,923 |

Logs, 10,000,000 feet B. M. (towed).

| | | |
|---|---|---|
| **Passengers:** | | |
| Arriving | number | 1,315 |
| Departing | do | 1,315 |
| Total | do | 2,630 |
| Total receipts and shipments | tons of 2,000 pounds | 35,255 |
| Valuation of receipts and shipments | | $732,137 |

There are no new lines of transportation.

## I I 2.

## IMPROVEMENT OF HARBOR AT AGATE BAY, MINNESOTA.

For a detailed description of this harbor see pages 2824–2825, Appendix K K, Report of the Chief of Engineers, United States Army, 1901, and earlier reports.

No work was done at this harbor by the United States during the fiscal year ending June 30, 1904.

In the matter of the suit brought by the United States attorney for the district of Minnesota in the United States district court against the Davidson Steamship Company for damages to the east breakwater, caused by the steamer *Shenandoah* in July, 1901, the first trial resulted in a verdict in favor of the United States for the full amount claimed.

On an appeal taken by the defendant a new trial was had in October, 1902, which resulted in disagreement of the jury. A third trial was held at the United States district court, Minnesota district, fifth division, in Duluth, October 21-27, 1903, and resulted in a verdict by the jury of $1,000 in favor of the United States.

There was no question as to the amount of damages sustained, which was $4,012.50, and the small sum awarded seemed to be simply a compromise as a last resort after the jury had been out sixty-three hours without agreement.

The above award is considered insufficient and unsatisfactory on the part of the United States, and a fourth trial will be held, the hearing of which is set for July, 1904.

The available balance, together with the appropriation recommended, will be expended in repairs to the breakwaters and for maintenance.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | [a]$2,116.13 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 257.50 |
| July 1, 1904, balance unexpended | 1,858.63 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 5,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT AGATE BAY, MINNESOTA.

| By act of Congress— | |
|---|---|
| Approved August 5, 1886 | $22,500.00 |
| Passed August 11, 1888 | 15,000.00 |
| Approved September 19, 1890 | 25,000.00 |
| Approved July 13, 1892 | 30,000.00 |
| Of August 18, 1894 | 30,000.00 |
| By act of Congress— | |
| Passed June 3, 1896 | $50,000.00 |
| Approved March 3, 1899 | 71,708.00 |
| Approved June 13, 1902 | 2,000.00 |
| Miscellaneous | 66.19 |
| Total | 246,274.19 |

COMMERCIAL STATISTICS.

*Statement of vessels arriving and departing at Agate Bay, Minnesota, for the calendar year 1903.*

| | |
|---|---|
| Steam | 2,728 |
| Sail or tow | 632 |
| Total | 3,360 |
| Estimated tonnage | 10,080,000 |
| Decrease | 906,000 |

*Receipts and shipments for 1903.*

| | Tons. |
|---|---|
| Ore shipped | 5,735,135 |
| Other freight received and shipped | 251,624 |
| Total | 5,986,759 |

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[a] Difference of $66.19 is amount deposited by United States attorney in 1901, account damages to breakwater by steamer *Volunteer*, not heretofore credited.

Beginning with 1900, amount of iron ore is stated in tons of 2,000 pounds; previous to that date in gross tons. All other tons are of 2,000 pounds.

Estimated value of freight received and shipped, 1903, $15,042,922.

There were no new lines of transportation established last year, but several new boats were added to the old lines.

## I I 3.

## IMPROVEMENT OF HARBOR AT DULUTH, MINNESOTA, AND SUPERIOR, WISCONSIN.

For a history of this harbor and the Government improvements see Report of the Chief of Engineers, United States Army, 1901, Appendix K K, page 2828. A detailed description of the condition of channels and other improvements is given in Bulletin No. 14, issued April 15, 1904, from the office of the Survey of Northern and Northwestern Lakes, pages 41-50.

Some shoaling having occurred in the Superior Harbor Basin and Superior Front channel, caused by deposits from the Nemadji River, and some at the outer end of the Superior entry, the same is now being removed under contract by the Lake Superior Contracting and Dredging Company, at the price of 12½ cents per yard. Work on this contract commenced May 25, 1904, and 24,050 yards were dredged up to June 30, 1904. Total amount to be dredged is about 80,000 yards.

### DULUTH SHIP CANAL.

The wiring of the new concrete piers for electric lights was done in May and June, 1904, by the Crowley Electric Company, under contract, after due advertisement, at a cost of $1,600. The cast-iron lamp-posts, 67 in number, and the semiopaque globes were furnished by the Government. The contractor furnished the lamps, wires, and all other fixtures. There are two globes to each lamp-post, and two 24-candlepower incandescent lamps within each globe, or 268 lamps in all.

By agreement the city of Duluth furnishes the electric current for these lights. The lights will be turned on July 2, 1904, for the first time. They are very ornamental and add to the attractiveness of the piers and adjoining grounds.

The city of Duluth is about to erect a suspended-car transfer, or aerial ferry, across the Duluth Ship Canal in accordance with the revocable license granted by the Secretary of War, dated September 6, 1901, and an act of Congress approved February 7, 1902. The foundations were built in 1901-2, but nothing further was done at that time on account of failing contractors. Another contract has since been entered into, this time by the city of Duluth and the Modern Steel Construction Company, of Waukesha, Wis., dated on or about March 16, 1904, under which the shop work has been in progress for the last few months.

Under this contract the company is to complete the bridge by November 1, 1904, and has given bonds in the sum of $100,000 for the performance of its provisions. The construction will be under the supervision of this office, as far as relates to Government requirements.

Plans have been prepared and approved by the Chief
for building a vessel yard on Minnesota Point, on a
by the United States for this purpose, about 800 feet
canal on the bay front. A bulkhead crib will be built
14 feet wide, sunk to a depth of 15 feet below low-water
rising 3 feet above datum. The yard behind this bulkhead
in shallow water will be filled with sand and leveled. A
will be built, extending from the north end of the
proposed harbor line a distance of 388 feet. This will
crib 12 feet wide, 8 feet above water, and a parapet 2 feet
walk, and the crib will reach a depth of 16 to 20 feet
The cribs will be filled with sand.

A slip will be dredged to give a clear depth of 12 feet
150 feet bottom width, and from the bulkhead out to the
foot depth.

This work is to be done the present season, and the U
buildings now at the foot of Seventh avenue west, on
are to be moved to the new site.

Condemnation proceedings are now well advanced for
title to a single lot 42 by 20 feet in size, which is needed
the rectangle on Minnesota Point. Perfect title to this lo
be obtained by purchase, as was possible with the remain
tract.

A portion of St. Louis avenue, which lay out in the wa
through the Government tract, has been vacated by the
council to permit of the proposed improvement of the
[illegible]

The U. S. S. [illegible], a vessel used for official journeys
[illegible] district, has been repaired and
[illegible] timbers and plank with
[illegible] lighting plant installed.
[illegible]

that of the Duluth Ship Canal. The estimated cost of reconstruction $925,000.

Briefly described, a trench 21 feet deep will be dredged for the oundation and bearing piles driven into the sand bottom to a depth f 16 feet with the aid of a water jet. The piles will be sawed off 18 eet below low-water datum and 3 feet above the bottom of the trench. he average load on a pile in the largest section will be 33 tons, and ome less in the other sections.

The substructure will consist of concrete monolithic blocks, built in lace in subaqueous molds. Alternate or "isolated" blocks are first uilt, each 16 feet long, and with spaces of 16 feet left vacant for the ntermediate blocks. The width of these blocks will be increased from one division or "section" to another, proceeding toward the lake, there being four different cross sections. The number of yards of concrete in one monolithic block is 75, 148, 194, and 458 in the respective sections. The mold for an isolated block consists of four sides, detachable, assembled and coupled together ashore, and transported and placed in position by means of a large self-propelling traveler equipped with steam power and four sets of hoisting tackle, one set for each corner of a mold, acting independently or synchronously, as desired. A mold for an intermediate block consists of two sides, which are clamped to the adjoining isolated blocks (previously built), the latter thus forming the ends of the mold.

The sides of a mold, either isolated or intermediate, are connected up, before placing in the water, with automatic, detachable fastenings, such that after the concrete has sufficiently hardened the sides are released by an operation performed above water, and removed one by one with the aid of the same mold traveler. The services of a diver are not required at any time.

The superstructure will form a separate construction, and will also consist of concrete built in place, in removable molds, superimposed on the substructure.

Attention is invited to the accompanying report[a] of Mr. Clarence Coleman, assistant engineer in charge of the Superior entry work, with 19 sheets of plans, and also a set of photographic views showing the work in progress of construction. Mr. Coleman's report, with the plans and views, gives a full and clear description of this work, the magnitude of which and the novelty in design and method of construction will insure general interest among the engineering profession at large.

The work during the season of 1903 and the following winter was mostly preparatory to the main work of laying concrete. The results accomplished up to June 30, 1903, are stated in the Report of the Chief of Engineers, United States Army, 1903, Appendix K K, page 1797.

During the past fiscal year the dredging of the trench for the westerly half of the south pier was completed; the bearing piles for same were driven and sawed off; 8,069.5 cubic yards of gravel for concrete were delivered in the stock pile, at $1.08¼; and 9,971 barrels of Portland cement, at a net cost of $1.77. Piles, timber, lumber, iron, and steel were purchased, and there were constructed trestles, 3 miles of track, molds, a mold traveler with 31-foot gauge, material bins and sheds, staging for concrete mixer, incline trestles for handling materials, a 10-ton derrick with 60-foot boom used in assembling molds, a floating pile driver, a steam pump for excavating sand from the pier trench, a steam derrick on a scow, and 12 buckets for depositing concrete in water.

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[a] Printed in Appendix A A A of the Annual Report of the Chief of Engineers for 1904, page 3779.

A cubical concrete mixer was purchased, 20 cars for transporting concrete and materials, 2 small locomotives of special design, and 2 steel travelers of special design for handling concrete buckets, self-propelled on a track of 14-foot gauge.

The laying of concrete commenced May 20, 1904. At the close of the fiscal year 33 subaqueous monolithic blocks had been built, requiring 5,058 cubic yards of concrete in place. Sixty-five hundred and thirty-two barrels of cement were used.

Mr. Coleman says:

> It is very gratifying to be able to report that the entire plant for performing this work has at this date been proved in actual practice, and notwithstanding much of it is of entirely original and novel design, it has worked in a most satisfactory manner. The question of handling, placing, and removing the large subaqueous molds without the aid of submarine divers has been most satisfactorily solved by the special devices designed for accomplishing the work.

A careful analysis of the cost of the concrete in place is given by Mr. Coleman, based on the actual operations and results of a certain typical week's work, taken after the machinery had been tested for about three weeks and put in fairly good condition. The output for that week was 1,383 yards, and it is shown that the cost per cubic yard in place was, for labor (including administration), fuel, oil, and waste, $0.5861; for materials (gravel, sand, and cement), $3.2166; and for plant, based on the assumption that it would be used for the entire work, and with the liberal allowance of 80 per cent for depreciation, $0.8400, making a total cost of $4.6427 per cubic yard in place. The sand cost nothing, as it had been deposited by a hydraulic dredge in the course of previous harbor improvements.

Bids for doing this work by contract had previously been received and rejected. The lowest was for $7.44 per yard in place, the United States to furnish the cement and sand and facilities for storage of cement, including a warehouse, wharf, and slip. Adding the actual cost of these to the price bid would bring the latter up to $9.7747, or more than twice the cost as now being done by hired labor. The Government also pays for eight hours' labor the same as a contractor usually pays for ten hours, which, if taken into account, would increase the above difference.

### LAKE COMMERCE.

The system of vessel reports which was inaugurated in 1895 has been kept up, and the commercial statistics accompany this report. These are as accurate as is practically possible to make them, being compiled from the individual reports of each trip of every vessel, in or out, made directly to this office.

These data are considered of much value by the public, as evidenced by the great demand upon this office for copies from railroad corporations, vessel agencies, commercial organizations, publishers of trade and technical journals, and others, a demand which is increasing yearly. The reports are mimeographed in this office for gratuitous distribution.

Fifty-two per cent of the freight passing the Sault locks in 1903 was for Duluth-Superior harbor.

### NEED OF A HARBOR PATROL.

This harbor is now so large, with its 49 miles of established harbor frontage and 17 miles of improved 20-foot channels, and its commercial business so great, moving 18,000,000 tons of freight in the last season, that it is found impossible to prevent obstructions and enforce regulations without special supervision.

For example, the rules prescribed by the Secretary of War limit the size of rafts brought through the entrances and channels, but there is sometimes a disposition on the part of those in charge of the rafts to disregard these rules, and it is hard to enforce their observance with the means now at hand without resort to prosecution, which is unsatisfactory, and generally fails to accomplish the purpose for which intended.

There is a United States watchman at the Duluth Canal who reports such violations, and he can do no more. He can not tell with certainty whether an approaching raft is too large until it enters between the piers, and then it is too late to stop it. What is needed in such a case is a tug, with a United States official and assistants aboard, to run out into the lake and meet the raft, measure its size, and, if found too large, require the towing crew to either reduce the size of the raft or bring it in through the other entrance.

The passage of rafts through the harbor also requires watching to see that the channels are not blocked and vessels delayed. There has been an average of 103,000,000 feet of logs brought into this harbor annually, in rafts, during the last three years.

There is more or less private dredging in progress each season in this harbor, and some of the dredge men are apt to dump improperly, if not watched, in or near channels, to save the time and cost of towing to the regular dumping grounds.

Refuse is liable to be deposited in channels, and ashes thrown out or pumped out of vessels into channels.

Encroachments on public channels by private persons, or corporations, building wharves beyond the established harbor lines require attention and checking.

Channels need to be examined from time to time, particularly after floods, to discover shoals and bars which would obstruct navigation.

Vessels sometimes anchor in basins or channels in such a way as to obstruct the passage of other vessels, or take up too much anchorage space.

It is evident that the prevention of obstructions and violations of rules can best be effected by the employment of special inspectors, empowered to arrest offenders, and provided with a steam tug and crew of men.

The necessity of a certain amount of dredging annually in order to maintain the channels of this harbor, which have been completed according to the approved project, has been stated in the Report of the Chief of Engineers, United States Army, 1901, Appendix K K, p. 2829.

It is believed that it would be wise to provide for the current needs of this harbor—that is, for maintenance of Government improvements, prevention of willful obstructions and violations of rules, and for the collection of statistics of the lake commerce of this port—by a Congressional enactment authorizing allotments for this purpose to be paid from some permanent fund upon annual estimates made by the engineer officer in charge of the district, or by an item in an annual appropriation bill, as the needs for the maintenance of the harbor are too great to depend upon the uncertainty of river and harbor bills.

An approximate estimate of cost would be as follows:

| | |
|---|---|
| Tug hire | $6,000 |
| 1 inspector, 2 deputy inspectors, 2 watchmen (at entrances)<br>6 laborers (for sounding through ice) | 6,000 |
| Dredging to remove shoals, from $10,000 to $30,000, depending on the occurrence of floods, say | 20,000 |
| 2 vessel recorders (at entrances)<br>1 vessel recorder (in office)<br>Printing blanks, etc | 3,000 |
| Office expenses | 5,000 |
| Miscellaneous expenses, labor, material, etc | 5,000 |
| Total | 45,000 |

After completion of work at Superior Entry a Government tug will be available for this work.

### NEMADJI RIVER BRIDGE.

Reconstruction of the Northern Pacific Railroad bridge across the Nemadji River, in the city of Superior, Wis., has been in progress since its commencement in December, 1903, in accordance with plans approved by the Secretary of War, under date of July 16, 1903, which provide for a steel draw span with two clear openings of 65 feet each.

This structure is to take the place of a combination draw span of a total length of about 230 feet, and with two clear openings of about 97 feet each, which is of insufficient strength to carry the new rolling stock which is proposed to be used.

Work on this reconstruction, which has been under the supervision of this office, was nearly completed at the close of the fiscal year.

### MAGNETIC.

Accompanying herewith is the final report[a] of Mr. J. H. Darling, United States assistant engineer, on observations for determining variation of the compass over the portion of Lake Superior lying westerly of the Apostle Islands, which were made in the fall of 1902 and spring of 1903, and mention of which was made in the Report of the Chief of Engineers, 1903, Appendix K K, page 1799. The principal results of this work have been printed in Bulletins Nos. 13 and 14, issued by the Survey of Northern and Northwestern Lakes, for the use of navigators. The present report, dated March 31, 1904, describes in detail the methods of observation and reduction, and will be of interest to investigators of magnetism in its relation to the mariner's compass, and of disturbances of the compass caused by local attraction originating in deposits of magnetic ore. The report is accompanied by maps, diagrams, and tabulated observations. The chart of variations, marked sheet I, should be of practical use to all navigators who visit the head of the lakes, and similar observations might well be extended over the remaining portions of Lake Superior, a lake which, along its northerly shores, is much subject to local attraction.

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[a] Printed in Appendix E E E of the Annual report of the Chief of Engineers for 1904, page 4133.

(This report was sent to the Chief of Engineers, through the division engineer, with my letter dated April 7, 1904, and attention is respectfully invited to paragraph 7 of said letter.)

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | [a]$416,935.21 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $151,060.48 | |
| For maintenance of improvement | 25,000.00 | |
| | | 176,060.48 |
| July 1, 1904, balance unexpended | | 240,874.73 |
| July 1, 1904, outstanding liabilities | | 8,000.00 |
| July 1, 1904, balance available | | 232,874.73 |
| July 1, 1904, amount covered by uncompleted contracts | | 174,500.00 |
| Amount (estimated) required for completion of existing project | | 520,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $520,000.00 | |
| For maintenance of improvement | [b]150,000.00 | |
| | | 670,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT DULUTH, MINN., AND SUPERIOR, WIS.

| | |
|---|---|
| By act of Congress of June 3, 1896 | $50,000.00 |
| By sundry civil act of— | |
| June 4, 1897 | 437,500.00 |
| July 1, 1898 | 770,138.00 |
| March 3, 1899 | 300,000.00 |
| June 6, 1900 | 793,187.50 |
| March 3, 1901 | 320,000.00 |
| June 28, 1902 | 459,727.50 |
| Act approved June 13, 1902 | 200,000.00 |
| Miscellaneous receipts | 667.50 |
| Total | 3,331,220.50 |

The following statement shows the manner in which the appropriations have been expended since June 30, 1896. The amount expended under the different classes of work includes the cost of soundings, superintendence, buoying, and contingencies:

| | |
|---|---|
| Dredging | $2,123,833.71 |
| Duluth Canal piers | 650,000.00 |
| Wisconsin Entry piers | 209,950.87 |
| Purchase of land | 106,561.19 |
| Total | 3,090,345.77 |

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[a] Difference of $117.50 was amount deposited in January and February, 1899, account, damages by vessels and not heretofore credited.

[b] For dredging plant (additional).

### ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT DULUTH, MINN.

| | |
|---|---|
| By act of Congress approved— | |
| March 3, 1871 | $60,000.00 |
| June 10, 1872 | 50,000.00 |
| Allotted from act passed March 3, 1873 | 36,049.20 |
| By act of Congress approved— | |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 35,000.00 |
| August 14, 1876 | 15,000.00 |
| June 18, 1878 | 30,000.00 |
| March 3, 1879 | 25,000.00 |
| June 14, 1880 | 25,000.00 |
| March 3, 1881 | 40,000.00 |
| By act of Congress passed August 2, 1882 | 45,000.00 |
| By act of Congress approved— | |
| July 5, 1884 | 45,000.00 |
| August 5, 1886 | 56,250.00 |
| By act of Congress passed August 11, 1888 | 80,000.00 |
| By act of Congress approved— | |
| September 19, 1890 | 100,000.00 |
| July 13, 1892 | 125,000.00 |
| By act of Congress of August 18, 1894 | 75,000.00 |
| Total | 852,299.20 |

The following statement shows the manner in which the appropriations have been expended. The amount expended under the different classes of work includes the cost of soundings, superintendence, buoying, and contingencies.

| | |
|---|---|
| Total amount expended to June 30, 1897: | |
| Breakwater | $110,000.00 |
| Dredging | 644,638.55 |
| Canal piers, etc | 97,660.65 |
| Total | 852,299.20 |
| Expended prior to present project: | |
| Breakwater | 110,000.00 |
| Canal piers, etc | 45,698.33 |
| Dredging | 122,354.05 |
| Total | 278,052.38 |
| Expended under the project adopted in 1881: | |
| Canal piers, etc | $51,962.32 |
| Dredging | 522,284.50 |
| Total | 574,246.82 |

### ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT SUPERIOR BAY AND ST. LOUIS BAY, WISCONSIN.

| | |
|---|---|
| By act of Congress approved— | |
| March 3, 1867 | $65,000.00 |
| April 10, 1869 | 45,000.00 |
| July 7, 1870 | 40,000.00 |
| March 3, 1871 | 60,000.00 |
| June 10, 1872 | 50,000.00 |
| Allotted from act approved March 3, 1873 | 68,950.80 |
| Allotted from appropriations for "Repairs of Harbors on Northern Lakes" | 5,455.00 |
| By act of Congress approved— | |
| August 14, 1876 | 5,000.00 |
| June 18, 1878 | 5,000.00 |
| March 3, 1879 | 5,000.00 |
| June 14, 1880 | 5,000.00 |
| March 3, 1881 | 15,000.00 |
| August 2, 1882 | 45,000.00 |
| July 5, 1884 | 45,000.00 |
| August 5, 1886 | 22,500.00 |

| | |
|---|---|
| By act of Congress— | |
| Passed August 11, 1888 | $50,000.00 |
| Approved September 19, 1890 | 65,000.00 |
| Approved July 13, 1892 | 70,000.00 |
| Of August 18, 1894 | 50,000.00 |
| Total | 695,883.80 |
| Aggregate | 4,879,403.50 |

EXPENDITURES.

| | |
|---|---|
| Amount expended under original project, adopted in 1867 | $258,000.00 |
| Amount expended under project recommended by Board of Engineers in 1873 | 77,513.26 |
| Amount expended under present project to June 30, 1897 | 360,370.54 |
| Total | 695,883.80 |

The following statement shows the manner in which the appropriations have been expended. The amount expended under the different classes of work includes the cost of examination, soundings, superintendence, buoying, and contingencies.

| | |
|---|---|
| Repairs and beach protection | $13,233.00 |
| Construction and repair to piers | 334,278.64 |
| Dredging | 348,372.16 |
| Total | 695,883.80 |

## LIST OF EXISTING CONTRACTS.

Contract was entered into with the Illinois Steel Company, of Chicago, Ill., dated January 30, 1903, approved by Chief of Engineers, February 21, 1903, for furnishing 65,000 barrels of Portland cement for Superior entry piers, south side, at $2.17 per barrel, delivered in sacks (four sacks to the barrel), less 10 cents each for sacks returned. Delivery to commence May 1, 1903, and be completed by September 15, 1904.

Contract was entered into with George A. Wieland, of Duluth, Minn., dated June 15, 1903, approved by Chief of Engineers July 9, 1903, for furnishing and delivering in stock pile at Superior entry, Wisconsin, 43,000 cubic yards of pebbles or gravel at $1.08¼ per cubic yard. Delivery to commence July 1, 1903; to continue at rate of 5,200 cubic yards per month during season of navigation, making a total of 20,800 cubic yards to be delivered during season of 1903. During season of 1904 delivery to be at rate of 5,550 cubic yards per month until 22,200 cubic yards have been delivered.

Contract was entered into March 28, 1904, with Lake Superior Contracting and Dredging Company, approved by Chief of Engineers April 9, 1904, for dredging about 80,000 cubic yards, more or less, in removing a shoal from Superior Harbor Basin in front of the Nemadji River, and some shoals from between the Superior entry piers. Work to commence as soon as practicable in the spring of 1904 and be completed by July 15, 1904. Price, 12¼ cents per cubic yard, scow measurement. (Time limit for completion was waived for a reasonable period by authority of the Chief of Engineers July 8, 1904.)

## COMMERCIAL STATISTICS, DULUTH, MINN.

*Comparative statement of arrivals and clearances for calendar years 1902 and 1903.*

| Year. | Arrivals. | Clearances. | Total. | Tonnage. | Average tonnage. |
|---|---|---|---|---|---|
| 1902 | 4,303 | 4,343 | [a] 8,646 | 13,678,026 | [b] 1,758 |
| 1903 | 4,816 | 4,843 | [c] 9,659 | 13,927,284 | [b] 1,568 |
| Increase or decrease | −518 | −500 | −1,013 | −249,258 | −190 |

[a] Steam, 7,439; sail, 1,207. [b] Exclusive of tugs. [c] Steam, 8,459; sail, 1,200.

*Commerce for the head of the Lakes (Duluth, Minn., and Superior, Wis., combined) for the calendar year 1903.*

[Tons of 2,000 pounds.]

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Soft coal | 3,219,675 | Iron ore | 10,387,457 |
| Hard coal | 997,733 | Copper | 33,663 |
| Limestone | 59,973 | Flour | 596,769 |
| Salt | 57,423 | Wheat | 779,860 |
| Machinery | 1,810 | Flax | 431,369 |
| Manufactured iron | 90,056 | Other grains | 275,353 |
| Oil | 20,957 | Wool | 7,321 |
| General merchandise | 171,616 | Lumber | 608,691 |
| Lumber | 3,793 | Shingles | 48,049 |
| Ties and posts | 11,074 | Lath | 8,759 |
| Poles and piles | 13,902 | General merchandise | 45,171 |
| Fish | 2,039 | Iron and machinery | 1,259 |
| Cement and lime | 40,212 | Miscellaneous | 3,132 |
| Building stone | 11,575 | | |
| Sand and gravel | 36,887 | | |
| Pulp wood | 261 | | |
| Miscellaneous | 879 | | |
| Total | 4,739,865 | Total | 13,226,853 |

| | |
|---|---|
| Total tons cargo entered and departed | [a] 17,966,718 |
| Valuation | $177,744,956 |
| Total arrivals and departures | 14,098 |
| Net registered tonnage | 23,250,358 |

*Arrivals and clearances of vessels at Superior, Wis., for 1903.*

| | |
|---|---|
| Steam | 4,705 |
| Sail | 747 |
| Total | 5,452 |
| Arrivals and clearances (not including dump scows) which passed in and out of Wisconsin entry | 2,336 |
| Average net tonnage of vessels (exclusive of tugs) | 1,974 |
| Net tonnage, Wisconsin entry | 4,077,925 |

*Vessel report for Superior Harbor for calendar year 1903.*

ENTERING.

[Tons of 2,000 pounds.]

| | Boats. | Net registered tonnage. | Tons of cargo. |
|---|---|---|---|
| Number which entered Superior Harbor loaded via Duluth Canal | 1,149 | 2,146,346 | 2,675,443 |
| Number which entered Superior Harbor light via Duluth Canal | 548 | 1,028,134 | ........... |
| Number which came in Wisconsin entry and discharged at Superior. | 267 | 253,680 | [b] 465,020 |
| Number which entered Wisconsin entry light or with rafts in tow | 779 | 1,330,877 | ........... |
| Total | 2,743 | 4,759,037 | 3,140,463 |

DEPARTING.

| | Boats. | Net registered tonnage. | Tons of cargo. |
|---|---|---|---|
| Number which took cargo from Superior and departed through Duluth Canal | 669 | 1,192,529 | 1,323,786 |
| Number which left Superior light and departed through Duluth Canal | 134 | 503,207 | ........... |
| Number which loaded at Superior and departed through Wisconsin entry | 1,060 | 2,296,847 | [c] 4,499,939 |
| Number which left Superior light and took cargo on at Duluth and departed via Duluth Canal | 316 | 624,201 | ........... |
| Number which departed through Wisconsin entry light or with booms in tow | 230 | 196,511 | ........... |
| Total | [d] 2,709 | 4,813,295 | 5,823,725 |

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[a] Does not include 81,125,000 feet B. M. of logs in rafts and 21,250 linear feet of piles.

[b] These figures do not include 70,615,000 feet of logs towed in through the entry by tugs.

[c] These figures do not include 79,605 tons loaded at Duluth.

[d] These figures do not include tugs which passed in and out of the entry with dump scows or with vessels in tow.

*Receipts and shipments, by lake, of leading articles during the calendar year 1903 at Superior Harbor.*

[Tons of 2,000 pounds.]

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coal | 2,935,478 | Iron ore | 4,447,882 |
| Building stone and rubble | 9,845 | Copper | 30,953 |
| Salt | 12,601 | Flour | 356,450 |
| Manufactured iron and machinery | 51,908 | Wheat | 474,666 |
| Oil and miscellaneous | 19,860 | Other grains | 416,811 |
| General merchandise | 51,208 | Wool | 2,996 |
| Ties, poles, etc | 16,896 | Lumber | 56,934 |
| Cement, limestone | 24,604 | Shingles and lath | 25,389 |
| Sand, gravel, and lumber | 18,063 | General merchandise | 11,146 |
| | | Miscellaneous | 548 |
| Total | [a]3,140,463 | Total | 5,823,725 |

[a] Not including logs.

*Recapitulation.*

| | Freight. | Valuation. |
|---|---|---|
| | *Tons.* | |
| Total receipts | 3,140,463 | $26,406,650 |
| Total shipments | 5,823,725 | 63,718,778 |
| Total receipts and shipments | [a]8,964,188 | 90,125,428 |

[a] Not including logs received and piles shipped.

| | |
|---|---|
| Passengers departing | 1,688 |
| Passengers arriving | 1,846 |
| Total | 3,534 |

*Detailed statement of arrivals and clearances of vessels, Superior, Wis., for the calendar year 1903.*

| Month. | Arrived. | Cleared. | Total. | Net registered tonnage. |
|---|---|---|---|---|
| April | 148 | 165 | 313 | 653,226 |
| May | 389 | 392 | 781 | 1,385,503 |
| June | 397 | 392 | 789 | 1,301,350 |
| July | 415 | 416 | 831 | 1,328,814 |
| August | 380 | 366 | 746 | 1,205,156 |
| September | 335 | 332 | 667 | 1,138,641 |
| October | 377 | 369 | 746 | 1,340,470 |
| November | 268 | 250 | 518 | 1,062,083 |
| December | 34 | 27 | 61 | 157,089 |
| Total | 2,743 | 2,709 | 5,452 | 9,572,332 |

Average net tonnage per vessel, exclusive of tugs, 1,974.

Of the number of vessels reported for 1903 there were 4,706 vessels. The steamers were divided as follows: 4,524 freight propellers, 201 passenger and freight combined, 109 excursion boats, and 708 tugs.

*Statement of arrivals and clearances of vessels for the year 1903.*

| | |
|---|---|
| Number of vessels | 5,452 |
| Net tonnage | 9,572,332 |

*New lines of transportation, Duluth-Superior, for the fiscal year ending June 30, 1904.*

Acme Steamship Company, 1 steamer, *Augustus B. Wolvin*, the largest vessel on fresh water, and few purely freight vessels on the ocean are larger. Her length over all is 560 feet; beam, 56 feet; molded depth, 32 feet. The hold is hopper shaped, 409 feet long, without bulkhead or division; 43 feet wide at top, which is arched, and 24 feet at bottom. The cubical capacity of hull is about 500,000 cubic feet. Capt. A. B. Wolvin, manager, Duluth, Minn.

The Globe Steamship Company, steamer *Sahara*, 496 feet long, 52 feet beam, and 28 feet depth. One steamer chartered. G. A. Tomlinson, manager, Duluth, Minn.

*Additions to existing lines during fiscal year ending June 30, 1904.*

W. A. Hawgood & Co., 2 new steamers.
Lake Erie Transportation Company, 2 new steamers.
Hutchinson & Co., 1 new steamer.
The Gilchrist Transportation Company, 2 new steamers.
Seither Transportation Company, 1 new steamer.
Great Lakes and St. Lawrence Transportation Company, 2 steamers chartered.
Western Transit Company, 2 new steamers.
M. J. Cummings, 1 new steamer.

## DULUTH-SUPERIOR HARBOR FOR THE CALENDAR YEAR 1903.

Total vessel freight received and shipped, 17,966,718 tons of 2,000 pounds, valued at $177,744,956.

Increase in freight tonnage since 1890, 531 per cent.

Increase in freight tonnage during past year, 2.6 per cent.

It is impossible to give precise figures of the marine commerce of the principal ports of the United States for comparison with Duluth-Superior Harbor for the reason that at ocean ports of the United States, as well as of foreign countries, no record of domestic tonnage is kept at the custom-houses, whereas on the Great Lakes a record is kept of the total marine commerce, both foreign and domestic. In the principal ocean ports of the United States the tonnage of the local and coastwise (domestic) marine commerce is several times greater than that of the foreign.

Any comparison, therefore, of the relative marine commerce of lake and ocean ports, based solely upon custom-house records is, for the reason just stated, incorrect and misleading.

From the commercial statistics (published in the Report of the Chief of Engineers, United States Army, for 1903), furnished by boards of trade and commercial and maritime exchanges to officers of the United States Corps of Engineers in charge of improvements at the various ocean ports, it would appear that, based upon annual vessel freight received and shipped, the relative standing of the principal ports of the United States is now as follows: (1) New York, (2) Philadelphia, (3) Duluth-Superior, (4) Boston.

The navigation season for Duluth-Superior Harbor averages only about eight months per annum, while for the three ocean ports mentioned above navigation is carried on during twelve months. Considering the mean monthly freight movement during the season of navigation, Duluth-Superior Harbor stands next to New York.

## REMARKS—DULUTH-SUPERIOR HARBOR, 1903.

*Vessel tonnage.*—Net registered tonnage is used, and is obtained from vessel reports made to this office, and checked by official marine directories.

*Valuations.*—Freight valuations were obtained from the various trade journals, commercial records, and the principal wholesale dealers, and are based on average wholesale prices on board vessels for exports, and landed on wharves for imports.

*Cargo received.*—Four million two hundred and fifty-six thousand and sixty tons of cargo were received through the Duluth Canal, and 483,805 tons, not including logs, through the Wisconsin entry. Seventy million six hundred and fifteen thousand feet B. M., of logs came through the Wisconsin entry, of which amount 62,475,000 feet B. M., came to Duluth.

*Cargo departing.*—Eight million six hundred and forty-seven thousand three hundred and nine tons of cargo departed through the Duluth Canal, and 4,579,544 tons through the Wisconsin entry. Of the latter amount, 79,604 tons were loaded at Duluth.

DIAGRAM SHOWING VESSEL FREIG

FOR HARBORS OF DULUTH AN

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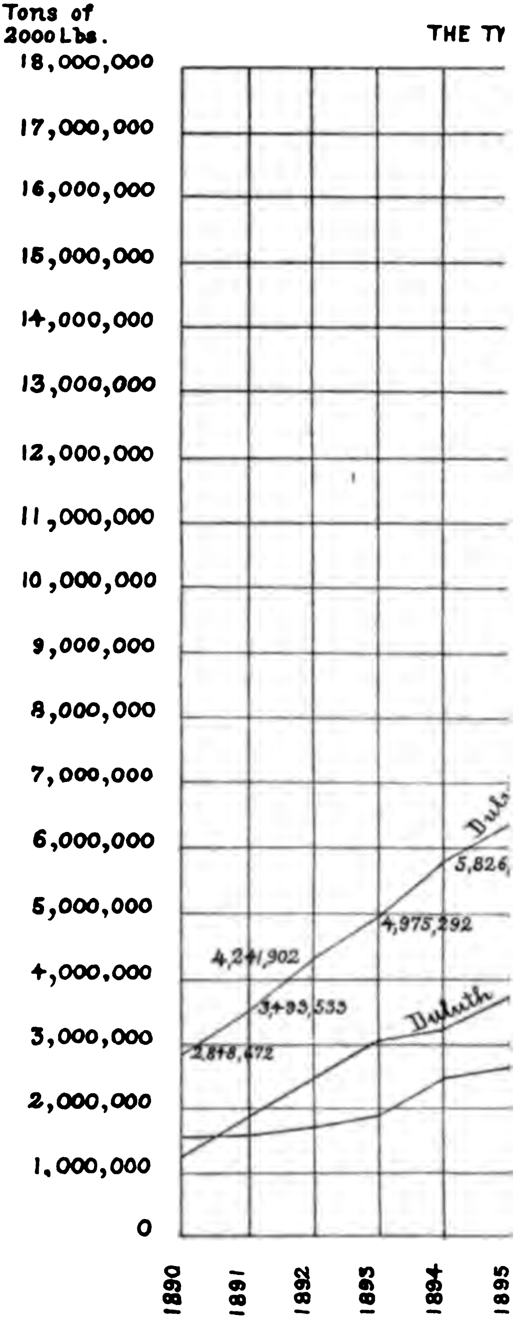

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*go tons.*—All freight tons used in this report are of 2,000 pounds.

rd coal shows an increase of 706,997 tons over 1902.

t coal shows an increase of 830,154 tons over 1902.

ieat and other grains show a decrease of 10,056,160 bushels, with a valuation of l6,982 less than in 1902.

n ore, a decrease of 496,899 tons under 1902.

› total freight traffic of 17,966,718 tons shows an increase of 460,925 tons over with a valuation of $16,850,483 less than in 1902.

*consin entry.*—There was a decrease of 900,742 net registered tons and 341,204 it tons under 1902.

› total number of passengers arriving and departing was 89,081, a decrease of l under 1902, and an increase of 54,963 over 1895.

art of the large number of passengers is due to the local excursion business.

erage net registered tonnage recorded at Duluth, exclusive of tugs, 1,758.

sels recorded at Duluth Canal were: Entering, 4,045; departing, 3,791. Net ered tonnage of vessels entering, 6,647,376; net registered tonnage of vessels ting, 5,802,096; total number of vessels entering and departing, 7,836; total net ered tonnage of vessels entering and departing, 12,449,472.

erage net registered tonnage of vessels arriving at and departing from Superior sive of tugs was 1,974.

sels recorded at Wisconsin entry were: Entering, 1,046; departing, 1,290; total, Net registered tonnage of vessels entering, 1,384,557; departing, 2,493,368; 4,077,925.

erage number of tons cargo received per day at Duluth and Superior, 19,346.

erage number of tons of cargo shipped per day from Duluth and Superior, 7.

› navigation season covered a period of two hundred and forty-five days. This koned from first departure for and last arrival from the lower lakes. The season for Duluth-Superior Harbor to and from Lake Superior ports only was longer, as some local boats ran every month of the year.

*luth Canal.*—First boat departed for lower lakes April 11. First boat entered lower lakes April 11.

t boat departed for lower lakes December 8. Last boat arrived from lower December 11.

rth shore boats were running at close of calendar year.

*consin entry.*—First boat arrived from lower lakes April 13. First boat departed wer lakes April 11.

t boat arrived from lower lakes December 7. Last boat departed for lower December 5. Last boat departed for Duluth December 6.

t of decrease in arrivals and departures is due, probably, to late opening and closing of interlake navigation and early laying up of Pittsburg Steamship any's fleet.

crease in valuation due to less shipments of the more valuable freight.

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## I I 4.

## IMPROVEMENT OF HARBOR AT PORTWING, WISCONSIN.

or a detailed description of this harbor, reference is made to the wing sources:

irrent summary, page 508, giving approved project, etc., House ıment No. 114, Fifty-sixth Congress, first session, containing rts on a preliminary survey, a survey project for improvement, nate of cost, and a complete map.

ılletin No. 14, Survey of Northern and Northwestern Lakes, page Also supplement to same No 2, page 5.

small map of the harbor is printed with the Report of the Chief ngineers for 1903.

y act of Congress approved June 13, 1902, the following provision made for the improvement of this harbor:

> proving the harbor of Port Wing, Wisconsin, in accordance with the report subd in House Document Numbered One hundred and fourteen, Fifty-sixth Con-, first session, for a harbor of refuge, twenty-five thousand dollars: *Provided*

That no part of said sum shall be expended until the title of the land necessary for the establishment of said harbor, according to said report, shall have been properly and legally conveyed by or through the authorities of Port Wing to the United States Government.

In 1902 the citizens of Port Wing took steps which resulted in the conveyance to the United States of a tract of land containing about 7 acres which was needed for the purpose of harbor improvement. Its boundaries are shown on the map accompanying the Chief of Engineers' Report for 1903.

For approved project, see current summary, page 508.

Upon the acquirement by the United States of the necessary land, and after due advertisement, contract was entered into with Hugo & Tims, dated March 28, 1903, for building the east pier, 800 feet long, building a pile revetment 126 feet long at inner end of east pier, dredging a channel 75 feet wide and 15 feet deep through the entrance, and partly dredging out the proposed slip along the slough.

Work under the contract began June 1, 1903. During the season there were dredged 24,333 yards, giving a channel through the entrance 14 feet at low-water datum for a narrow width, and vessels drawing 14 feet used the channel without difficulty during the prevailing stage of water. The east pier, 800 feet long, was built in accordance with the project, and a revetment or wing wall at the inner end of the pier, 45 feet long.

The cost of the improvement up to June 30, 1904, has been $21,476.07. The approved project is now about half completed.

A survey of the entrance on May 28, 1904, showed surprisingly little change in depth since the survey of October, 1903, described on page 66 of Bulletin No. 14. This is in striking contrast to the former history of this harbor, as the opening of navigation has always found the entrance obstructed by sand bars, requiring dredging. Either the new east pier, which is intact and in excellent condition, has been remarkably efficient in stopping the movement of sand, or the usual shoaling agencies have been absent.

The best water is between the private vessel range and the pier, but nearer the range than the pier. Directly on the vessel range is a least depth of 11.8 feet, while at a distance of 20 feet east of the range the least depth is 14.2 feet. The Government will deepen and widen the entrance channel by dredging, some time during the present season.

The private channel along the lumber wharf has shoaled some since last season, and a dredge is now at work deepening it.

The available balance and the appropriation recommended will be expended for the completion of the project.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $24,218.64 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 20,694.71 |
| July 1, 1904, balance unexpended | 3,523.93 |
| July 1, 1904, amount covered by uncompleted contracts | 2,750.00 |
| Amount (estimated) required for completion of existing project | 19,992.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 19,992.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

### APPROPRIATIONS.

By act of Congress approved June 13, 1902 .......................... $25,000

### CONTRACT IN FORCE.

Contract was entered into with the Northern Dredge Company of Duluth, Minn., February 18, 1904, for dredging about 15,000 cubic yards in removing shoals, dredging a turning slip, etc., at 17 cents per cubic yard; approved by the Chief of Engineers March 3, 1904. Time to begin work as soon as the conditions of ice and weather would permit in the spring of 1904, and to be completed June 30, 1904. Time for completion extended for a reasonable period by the Chief of Engineers, June 29, 1904.

### COMMERCIAL STATISTICS.

*Arrivals and clearances of vessels at Portwing, Wis., for calendar year 1903.*

| Vessels. | Arrivals. | Clearances. | Total. | Tonnage. |
|---|---|---|---|---|
| Steam | 151 | 151 | 302 | 74,824 |
| Sail | 11 | 11 | 22 | 13,676 |
| Tugs | 110 | 110 | 220 | 5,500 |
| Total | 272 | 272 | 544 | [a] 94,000 |

[a] Partly estimated.

Passengers arriving, 550; departing, 550; total, 1,100.

| Freight received and shipped. | Tons.[a] | Valuation. |
|---|---|---|
| Brownstone | 11,200 | $78,400 |
| General merchandise | 1,750 | 288,750 |
| Shingles (3,000 M) | 300 | 6,750 |
| Lumber (17,930,000 feet B. M.) | 26,895 | 275,584 |
| Cedar poles and piles (78,000) | 9,975 | 120,900 |
| Cedar ties and posts (41,000) | 1,819 | 12,420 |
| Fish | 30 | 2,250 |
| Total | 51,969 | 785,054 |

[a] Tons of 2,000 pounds.

## I I 5.

## IMPROVEMENT OF HARBOR AT ASHLAND, WISCONSIN.

For a detailed description of this harbor see pages 2863-2864, Appendix K K, Report of the Chief of Engineers, United States Army, for 1901 and earlier reports.

By act of Congress approved June 13, 1902, the sum of $40,000 was appropriated for continuing improvement and for maintenance of this work.

Under this appropriation the harbor front channel was extended 900 feet westward in June, 1903, as described in the Report of the Chief of Engineers for 1903.

The contract entered into with A. Donald & Co., dated March 23, 1903, provided for placing riprap alongside and on top of a portion of the breakwater, which is a temporary structure of piles and slabs, so as to form a rubble mound with the present breakwater as a hearting.

Previous to this work, it should be stated, a large quantity of dredged material from the United States channel and from private slips had been dumped alongside the breakwater during recent years, amounting to probably as much as 300,000 yards, for the purpose of forming a partial embankment of earth and to serve as a foundation for the riprap embankment. This earth fill raised the bottom to a height of 10 feet or more for the greater portion of the length of the breakwater, and it is expected that more will be added. All private dredgings are required by this office to be so deposited. This earth fill has therefore been placed without cost to the United States, excepting for the salary of an inspector to watch and direct the private dumping at times.

The work of depositing rock under the present contract began June 6, 1903. Up to June 30, 1903, 2,722 tons had been placed, as reported in 1903. Work was continued during the season of 1903, resumed in the spring of 1904 under an extension of time, and the contract was completed on June 29, 1904. Amount of rock placed during the fiscal year ending June 30, 1904, was 29,277 tons. The total amount of rock placed under said contract was 31,999 tons, at the price of 85 cents per ton of 2,000 pounds, and a contract cost of $27,199.15. This revetted 1,766 linear feet of the breakwater, beginning at the east end of the older and narrower portion (20 feet wide), which was built in 1889 and is the most decayed. The point of beginning is 1,021 feet from the extreme easterly end of the breakwater. The portion thus revetted is 24 per cent, or about one-fourth of the entire length of breakwater, and all of it needs the same treatment for maintenance. The riprap placed last year is now intact and has settled but little, or something like one-tenth of a foot on an average, and promises to be permanent and effective. The remainder of the breakwater should be revetted as soon as possible to prevent its going to pieces. This is deemed of more importance at the present time than further extensions of the breakwater.

The harbor front channel, as extended 900 feet in 1903, now reaches to 100 feet west of the prolonged west line of Beaser avenue. The extension is 100 feet wide, with a least depth of 19 feet, as shown by a survey made September 16, 1903. The entire dredged channel is about 4,360 feet long, with a least depth of 18 feet at low-water datum for a width of 90 to 140 feet. The channel is not marked in any way at present. It is straight, and at the northerly end the east line of the channel is 500 feet off the outer end of the Commercial dock, while at the south end the east line passes 60 feet outside the Barker & Stewart lumber docks, and terminates off the fourth one of this set of lumber docks, counting from the north. The channel can be used by the largest vessels at the usual stages of water.

Available balance and appropriation recommended will be applied to further dredging and maintenance.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $38, 801. 44 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $5, 000. 00 | |
| For maintenance of improvement | 23, 947. 68 | |
| | | 28, 947. 68 |
| July 1, 1904, balance unexpended | | 9, 853. 76 |
| July 1, 1904, outstanding liabilities | | 6, 531. 90 |
| July 1, 1904, balance available | | 3, 321. 86 |
| Amount (estimated) required for completion of existing project | | 386, 500. 00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $25, 000. 00 | |
| For maintenance of improvement | 100, 000. 00 | |
| | | 125, 000. 00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

---

### ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT ASHLAND, WIS.

| By act of Congress— | |
|---|---|
| Approved August 5, 1886 | $22, 500 |
| Of August 11, 1888 | 60, 000 |
| Approved September 19, 1890 | 60, 000 |
| Approved July 13, 1892 | 45, 000 |
| Of August 18, 1894 | 25, 000 |
| By act of Congress— | |
| Passed June 3, 1896 | $27, 000 |
| Approved March 3, 1899 | 35, 000 |
| Approved June 13, 1902 | 40, 000 |
| Total | 314, 500 |

---

### COMMERCIAL STATISTICS.

*Arrivals and clearances of vessels at Chequamegon Bay (Ashland and Washburn) for the calendar year 1903.*

| | Number. | Net registered tonnage. |
|---|---|---|
| Arrivals | 1, 240 | 1, 711, 096 |
| Clearances | 1, 239 | 1, 709, 745 |
| Total | 2, 479 | 3, 420, 841 |

*Shipments and receipts of principal articles during calendar year 1903.*

| Shipments. | Tons. | Receipts. | Tons. |
|---|---|---|---|
| Iron ore | 3, 161, 893 | Coal, hard | 38, 120 |
| Pig iron | 19, 022 | Coal, soft | 416, 963 |
| Lumber (273,717,000 feet) | 410, 575 | Merchandise | 1, 983 |
| Grain (4,460,909 bushels) | 133, 830 | | |
| Total | 3, 725, 320 | Total | 487, 066 |

Total receipts and shipments, 4,212,386 tons.
Total valuation, $20,904,356.
Logs, 250,000 M feet B. M.

NOTE.—There was in addition a local business between Ashland and Washburn and Bayfield of 2,700 trips of ferryboats carrying about 55,000 passengers and 60 tons of freight, and a number of tugs towing stone, etc.

## I I 6.

## IMPROVEMENT OF HARBOR AT ONTONAGON, MICHIGAN.

For further details see previous Annual Reports of the Chief of Engineers, United States Army, particularly the one for 1896.

A survey of the harbor and of the river up to a distance of about five-eighths of a mile above the bridge was made in June, 1903, under directions of this office, by H. H. Wadsworth, assistant engineer. A reduced copy of the resulting map accompanies the report for 1903.

By act of Congress, approved June 13, 1902, the sum of $5,000 was appropriated for the maintenance of this work. The sum was mostly expended in dredging the harbor above the entrance piers, work on which began June 29, 1903, and was completed July 7, 1903. Contractor, James Pryor. Amount dredged was 18,054 yards. Price, 23 cents per yard. This price was high, on account of the small size of the contract and the distance necessary to tow the dredge.

This dredging made a channel 1,000 feet long and 100 feet wide, with least depth of 15 feet at low-water datum, through the bar at inner end of the entrance piers and up to within 50 feet of the lumber dock and Commercial dock. Elsewhere between the piers, where dredging could not be done for want of funds, the least available depth was 12.5 feet at low-water datum, and this is therefore the maximum draft that could be carried at the time of the last survey in 1903.

For results of a preliminary examination of this harbor, authorized by the river and harbor act approved June 13, 1902, see current summary, and House Document, No. 235, Fifty-eighth Congress, second session; also Appendix I I 14, herewith.

Available balance and appropriation recommended will be applied to further dredging and maintenance.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $5,156.87 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 4,821.51 |
| July 1, 1904, balance unexpended | 335.36 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 10,000.00 |

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT ONTONAGON, MICH.

| | | | |
|---|---|---|---|
| By act of Congress— | | By act of Congress— | |
| Approved March 2, 1867 | $97,600 | Approved August 5, 1886 | $13,000 |
| Approved July 7, 1870 | 10,000 | Passed August 11, 1888 | 12,500 |
| Approved June 23, 1874 | 23,000 | Approved September 19, 1890 | 10,000 |
| Approved March 3, 1875 | 25,000 | Approved July 13, 1892 | 20,000 |
| Approved August 14, 1876 | 15,000 | Passed August 7, 1894 | 7,000 |
| Approved June 18, 1878 | 15,000 | Passed June 3, 1896 | 10,000 |
| Approved March 3, 1879 | 17,000 | Received on account of damage to piers | 28 |
| Approved June 14, 1880 | 15,000 | Approved June 13, 1902 | 5,000 |
| Approved March 3, 1881 | 20,000 | | |
| Passed August 2, 1882 | 20,000 | | |
| Approved July 5, 1884 | 15,000 | Total | 350,128 |

COMMERCIAL STATISTICS.

*Arrivals and clearances of vessels at Ontonagon, Mich., for calendar year 1903.*

| | Class. | Number. | Net registered tonnage. |
|---|---|---|---|
| Arrivals | Steamers | 161 | 57,505 |
| Clearances | ....do | 161 | 57,505 |
| Total | | 322 | 115,010 |

*Principal articles received and shipped, 1903.*

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| General merchandise | 2,203 | General merchandise | 301 |
| Coal | 300 | Timber | 375 |
| Fish | 220 | Lumber | 4,500 |
| | | Farm produce | 91 |
| Total | 2,723 | | |
| | | Total | 5,267 |

Logs received, 1,500,000 feet B. M.; logs shipped, 900,000 feet B. M.

*Freight received and shipped.*

[Tons of 2,000 pounds.]

| Items. | | Quantity. | Valuation. |
|---|---|---|---|
| General merchandise | tons | 2,504 | $413,160 |
| Coal | do | 300 | 1,200 |
| Fish | do | 220 | 16,500 |
| Farm produce | do | 91 | 9,100 |
| Timber | cubic feet | 15,000 | 9,000 |
| Lumber | M feet B. M. | 3,000 | 46,110 |
| Logs | do | 2,400 | 28,800 |
| Total valuation | | | 523,870 |

## I I 7.

## IMPROVEMENT AND OPERATING AND CARE OF WATERWAY FROM KEWEENAW BAY TO LAKE SUPERIOR, MICHIGAN.

For the history of this waterway and its purchase by the United States see Report of the Chief of Engineers for 1892, Appendix II, page 2158. For the work of improvement by the United States see subsequent annual reports. A complete detailed description of this waterway is also given in Bulletin No. 14, published by the survey of the Northern and Northwestern Lakes, April 15, 1904, pages 60 to 65.

The dredging under contract with James Pryor, which was in progress June 30, 1903, was completed September 9, 1903. With the completion of this contract the authorized appropriation of $1,065,000, by act of Congress approved June 3, 1896, was practically exhausted. The approved project is not fully completed, however, and about $45,000 additional funds are needed in order to make a channel 20 feet deep and 120 feet wide throughout. See current summary for further details.

There is now a minimum depth of 20 feet at low-water datum throughout this waterway, and generally a width of 120 feet or more having this depth. There are two localities where the width is deficient: one being at the upper end of Portage River, from Range Light No. 15 to the open lake, where there is a minimum width of about 100 feet at two points. The other is on the Rouleau Range in the upper portion of Portage Lake, through the shoals between High Point and Rouleau Point, where the minimum width for a depth of 20 feet is not more than 75 feet.

### OPERATING AND CARE.

*Location.*—The Portage Lake ship canals constitute the waterway across Keweenaw Point in the State of Michigan, from Keweenaw Bay to Lake Superior, there being about 25 miles of water route, consisting of 5½ miles of Portage River, with its four cuts, 17 miles of Portage Lake, and 2¼ miles in the upper canal from the head of Portage Lake to Lake Superior.

Under authority of the river and harbor act of September 19, 1890, the Secretary of War allotted $15,500 for operating and care of canals and other works of navigation, to be applied to Portage Lake and Lake Superior canals, Michigan, for the fiscal year ending June 30, 1904.

The approved project for the expenditure of this allotment is to maintain the depth and width obtained by the work of improvement; to keep a record of the vessels and their tonnage using the canals; to exercise the necessary care in enforcing regulations for the use of the canals; to make frequent surveys to determine changes and to check up work done in dredging; to guard against encroachments on the legally established harbor lines, and to perform other work incident to the operation and care of the canals. The amount allotted has been expended in carrying out the above programme of duties.

Dredging was done to the extent of $4,052.33, and consisted in removing shoals from Portage River at Cut 3, from the Upper Canal near Lilly Pond, and from the Rouleau Range course.

The new survey of this waterway was completed in 1903, and the mapping of same completed in May, 1904. There are twelve large sheets covering this survey, mostly on a scale of 400 feet to 1 inch. These will be used by the United States Lake Survey in the preparation of sailing charts.

Repairs have been made to the breakwaters at the upper entrance and lower entrance, and to revetments, at a cost of $3,131.

Two watchmen have been employed, one at the upper canal and one at Portage River. Each has kept a record of all passing vessels and rafts, reported damages to piers and revetments from collisions, violations of rules and regulations, and read a water gauge. The watchman at upper canal also kept a record of three wave dynamometers located on the breakwater piers.

Encroachments upon public channels by structures or by dumping of material or refuse has been watched and prevented. Water-gauge readings at Houghton have been continued thrice daily. This gauge is well referred to low-water datum and to sea level, and, being well protected from the waves and swells of the lake, furnishes a good standard for the stage of Lake Superior.

The immediate charge of this waterway has continued under the management of Mr. G. A. Marr, assistant engineer and superintendent, whose complete reports on operations have been made use of in the preparation of the foregoing matter.

The rules and regulations prescribed for this waterway by the Secretary of War, October 9, 1894 (see Report of the Chief of Engineers, United States Army, 1895, Appendix H H, p. 2563), and amended July 25, 1900, were further amended by the Secretary of War May 27, 1904, so as to limit the speed of vessels exceeding 200 tons to 6 miles per hour while passing along the harbor fronts of the cities of Houghton and Hancock, and prescribing the same speed for the Upper Canal. The complete rules now stand as follows:

### *Law, rules, and regulations for the Portage Lake ship canals across Keweenaw Point, Michigan.*

[Extract from act of Congress, August 18, 1894.]

SEC. 4. That it shall be the duty of the Secretary of War to prescribe such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are, or that hereafter may be owned, operated, or maintained by the United States as in his judgment the public necessity may require.

Such rules and regulations shall be posted in conspicuous and appropriate places for the information of the public, and every person and every corporation which shall knowingly and willfully violate such rules and regulations shall be deemed guilty of a misdemeanor and, on conviction thereof in any district court in the United States within whose territorial jurisdiction such offense may have been committed, shall be punished by a fine not exceeding five hundred dollars, or by imprisonment (in the case of a natural person) not exceeding six months, in the discretion of the court.

### RULES AND REGULATIONS.

1. *Authority of canal officers.*—The movement of all boats and floating things in the canals, and in the approaches thereto, shall be under the direction of the superintendent or his authorized assistants.

In case of any boat, vessel, or other craft, or raft sinking or grounding in the canal, or otherwise obstructing it, the officer or agent of the United States in charge of the canal shall have the right to take such possession of such vessel, boat, or other craft, or raft, as shall be necessary for the purpose, and remove it, and clear the canal of the obstruction caused by it, and no one shall interfere with or prohibit him from doing so, or do anything that will tend to interfere with or prohibit him from doing so; provided, that the officer or agent of the United States may, in his discretion, give notice in writing to the owners of any vessel, boat, or other craft, or raft obstructing the canal as aforesaid.

2. *Signals.*—On entering the Upper Canal at either entrance, steamers or tugs must blow their whistles for one minute, and in case two boats shall be in the canal at the same time, each shall so modify its speed as to pass the other at "Lily Pond," and when one arrives at Lily Pond before the other, a stop must be made until the other arrives and passes. In navigating the lower canals vessels will be governed by Rule V of the rules and regulations for the government of pilots navigating seas, gulfs, lakes, bays, sounds, or rivers adopted by the board of supervising inspectors.

"RULE V. Whenever a steamer is nearing a sharp bend or curve in the channel where from the heights of the banks or other cause a steamer approaching from the opposite direction can not be seen from a distance of half a mile, the pilot of such steamer, when he shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam whistle, which signal shall be answered by a similar blast given by the pilot of any approaching steamer that may be within hearing. Should such signal be so answered by a steamer upon the farther side of such bend, then the usual signals for the meeting and passing shall immediately be given and answered, but if the first alarm-signal of such pilot be not answered he is to consider the channel clear and govern himself accordingly."

3. *Speed.*—Vessels exceeding 200 tons shall not be allowed to proceed at a speed greater than six statute miles per hour through that part of Portage Lake in front of the cities of Houghton and Hancock, namely, between a point one and one-half

(2½) miles below the Houghton and Hancock bridge and the Atlantic Point light, which is about one and three-fourths (1¾) miles above same bridge. The same speed must not be exceeded while passing through the Upper Canal.

4. *Keeping in the center.*—In passing through the canals the center must be kept all the way through, except in passing other craft.

5. *Rafts.*—The passage of "bag" or "sack" rafts or of loose logs into or through the canals is prohibited.

Rafts shall be made up with logs parallel to each other, secured and held closely together by cross sticks, chains, or cable at each set of joints in the booms.

Rafts shall not be of greater dimensions either way than 50 feet wide by 600 feet long, and if longer than 300 feet shall be handled by two tugs, and in all cases must be handled by sufficient tug power to make headway against the current and guide the raft so as to give half the channel to passing vessels.

No raft shall pass through the Upper Canal—i. e., between Lake Superior and Portage Lake—unless by special permission of the superintendent or his authorized assistants, who will direct a time for passage that will least interfere with other navigation.

Masters of tugs and other vessels in charge of rafts are required to avoid damaging canal revetments and displacing buoys and spars. They shall keep careful watch when passing aids to navigation, and should any be accidentally displaced they shall make every effort to leave the same in shoal water out of the main channel, and report the fact to the superintendent or his authorized assistants.

6. *Harbor of refuge.*—In case the Upper Canal is used as a shelter from storms all crafts so using it are required to make fast at a point known as Lily Pond, midway between Portage Lake and Lake Superior, and, except in the case of storms, the use of the canal longer than twenty-four hours shall require special permission of the superintendent.

7. *Making fast.*—Making fast to the trestles of the elevated walk leading to the pierhead light-house, to the entrance piers, or to the revetments at the sides of the canal, except at Lily Pond, is strictly prohibited.

8. *Injury to piers, cribs, and sheet piling.*—Vessels shall use great care not to strike or injure the cribs, piers, sheet piling, or any structures pertaining to the canals.

9. *Refuse in canals.*—No person shall roll or throw any stones, ashes, cinders, or other material into the canal or the approaches thereto, or place any such material on any bank or berm of the canals, so that it is liable to be rolled, thrown, or washed in.

10. *Draft of boats.*—No vessels shall enter the canals whose actual draft exceeds the least depth of water in the channels of the canals as given by the superintendent.

11. *Obstructing navigation.*—Anyone who shall willfully or through carelessness in any way obstruct the free navigation of the canals, or by the violation of any of the laws or regulations governing the canals or those using them delay or inconvenience any boat having the right to use the canals will be liable to prosecution, and shall be responsible for all damages and delays, and for the expense of removing the obstructions.

12. *Occupation of United States piers, etc.*—No person or parties shall tie, or moor against the canal revetments or piers, scows, rafts, or vessels of any kind, to load or unload into or from said scows or vessels across the canal revetments or piers, cordwood, timber, or material of any kind, or pile the same upon the canal revetments or piers, or right of way of canals.

13. *Commercial statistics.*—The masters or clerks of vessels using the canals shall furnish in writing to the superintendent or his authorized assistants, a detailed statement of passengers and cargo carried.

Approved: October 9, 1894.

DANIEL S. LAMONT, *Secretary of War.*

Amended by Secretary of War, July 25, 1900, and May 27, 1904.

### SPECIAL DIRECTIONS.

[Read carefully.]

Statements for vessel reports should include all freight and passengers carried through the canals and all put off or taken on in Portage and Torch lakes. Vessels stopping at Portage and Torch Lake points, and returning the same way, will make separate reports for up and down business. When passing entirely through, only one report is necessary.

When tons are given, short tons of 2,000 pounds, and not long tons of 2,240 pounds, are meant.

After filling out the statement, fold twice, seal the gummed edge, and mail promptly at the first post-office in the United States. No stamp or additional address is necessary.

All vessels using these canals are required to conform promptly to the above.

NOTE.—The office of the superintendent of the canals is at Houghton, Mich. There is a watchman at the Upper Canal, and also at Portage River.

Books containing blank forms for reports can be obtained at the office of the superintendent at the "Soo" canal, at the office in Houghton, and at the United States Engineer Office, Providence Building, Duluth, Minn.

G. A. MARR,
*U. S. Assistant Engineer, Superintendent,*
*First National Bank Building, Houghton, Mich.*

CHAS. L. POTTER,
*Captain, Corps of Engineers, U. S. Army, in charge.*

## *Money statements.*

### IMPROVEMENT.

| | |
|---|---|
| July 1, 1903, balance unexpended | [a] $8,803.40 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 8,803.40 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement in addition to the balance unexpended July 1, 1904 | 45,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

### OPERATING AND CARE OF CANAL.

| | |
|---|---|
| July 1, 1903, amount allotted for fiscal year 1904 | $15,500.00 |
| June 30, 1904, amount expended during fiscal year 1904 | 15,500.00 |
| July 1, 1904, amount allotted for fiscal year 1905 | 15,000.00 |

### APPROPRIATIONS.

| | |
|---|---|
| Act September 19, 1890: | |
| For the purchase of Portage canals | $350,000.00 |
| For maintenance to June 30, 1892 | 10,000.00 |
| For harbor lines, Portage Lake | 5,128.70 |
| Total | 365,128.70 |

The above amounts were expended for the purposes for which appropriated.

### ABSTRACT OF APPROPRIATIONS FOR IMPROVING WATERWAY FROM KEWEENAW BAY TO LAKE SUPERIOR, MICHIGAN.

| | | | |
|---|---|---|---|
| By act of Congress— | | By act of Congress— | |
| Approved July 13, 1892 | $50,000.00 | Approved March 3, 1901 | $145,000.00 |
| Of August 18, 1894 | 130,000.00 | Approved June 28, 1902 | 10,000.00 |
| Passed June 3, 1896 | 50,000.00 | Miscellaneous | 237.68 |
| Approved June 4, 1897 | 350,000.00 | | |
| Approved July 1, 1898 | 450,000.00 | Total | 1,295,237.68 |
| Approved June 6, 1900 | 110,000.00 | | |

The following statement shows the manner in which the appropriations have been expended. The amount expended under the different classes of work includes the cost of examinations, soundings, superintendence, buoying, and contingencies:

| | |
|---|---|
| Dredging | $504,803.40 |
| Pier work, revetment, etc | 781,028.28 |
| Purchase of land | 9,406.00 |
| Total | 1,295,237.68 |

---

[a] Difference of $237.68 is amount deposited by Solicitor of Treasury June 8, 1901, amount of compromise in suit of United States *v.* Fitzgerald & Norris, not heretofore credited.

*Allotments for operating and care of Portage Lake and Lake Superior canals, Michigan, from the permanent indefinite appropriation of act of July 5, 1884, for operating and care of canals, etc.*

| | | | |
|---|---|---|---|
| July 1, 1892 | $31,028 | July 1, 1900 | $8,300 |
| July 1, 1893 | 11,647 | July 1, 1901 | 8,500 |
| July 1, 1894 | 8,000 | July 1, 1902 | 9,000 |
| July 1, 1895 | 11,500 | July 1, 1903 | 15,500 |
| July 1, 1896 | 8,300 | July 1, 1904 | 15,000 |
| July 1, 1897 | 8,300 | | |
| July 1, 1898 | 8,300 | Total | 151,675 |
| July 1, 1899 | 8,300 | | |

Previous to the 1902 allotment all the amounts were expended in maintaining the canals, except $117.36 of the 1892 allotment, which amount reverted to the Treasury. The $15,000 allotted July 1, 1904, will be expended during the fiscal year ending June 30, 1905.

### COMMERCIAL STATISTICS.

*Statistics of vessels passing through the canals during the calendar year 1903.*

| | Bound up. | | Bound down. | |
|---|---|---|---|---|
| | Number. | Net tonnage. | Number. | Net tonnage. |
| Steam | 1,327 | 1,264,721 | 853 | 542,989 |
| Sail | 514 | 345,383 | 293 | 209,034 |
| Total | 1,841 | 1,610,104 | 1,146 | 752,023 |

| | |
|---|---|
| Total number of vessels up and down | 2,987 |
| Total net tonnage | 2,362,127 |

*Openings and closings of navigation in Portage Lake ship canals, Michigan, while in charge of the United States, 1891 to 1903, inclusive.*

| Date of opening. | Steamer. | Date of closing. | Steamer. |
|---|---|---|---|
| | | November 30, 1891 | A. L. Hopkins. |
| April 26, 1892 | Nipigon. | November 30, 1892 | S. F. Hodge. |
| May 9, 1893 | Jos. L. Hurd. | November 29, 1893 | J. H. Shrigley. |
| April 22, 1894 | Japan. | November 30, 1894 | Jay Gould. |
| April 25, 1895 | Annie R. Hennes. | December 2, 1895 | Matoa. |
| April 24, 1896 | City of Duluth. | November 26, 1896 | Cumberland. |
| April 23, 1897 | Peerless. | December 2, 1897 | Japan. |
| April 17, 1898 | Iroquois. | December 4, 1898 | Martin Swain (tug). |
| May 1, 1899 | R. G. Stewart. | December 15, 1899 | Cora A. Sheldon, with whaleback No. 137. |
| April 19, 1900 | Bon Voyage. | December 8, 1900 | Cuba. |
| April 23, 1901 | Mabel Bradshaw. | December 8, 1901 | Clyde, with Amboy. |
| April 4, 1902 | Bon Ami. | December 13, 1902 | Grover. |
| April 15, 1903 | W. H. Gratwick. | December 9, 1903 | Hutchinson. |

*Statistics of tugs passing through the canals during the calendar year 1903.*

| | Bound up. | Bound down. |
|---|---|---|
| Trips .... number | 722 | 725 |
| Net registered tonnage | 27,549 | 27,053 |
| Vessels .... number | 30 | 12 |
| Scows .... do | 318 | 325 |
| Rafts .... do | 25 | 110 |
| Booms .... do | 133 | 81 |
| Logs .... M feet | 3,654 | 13,675 |
| Lumber .... do | 4,443 | 50 |
| Timber .... do | 5,731 | 290 |
| Cordwood .... cords | 1,006 | 140 |
| Building stone .... tons | 15,165 | .......... |
| Coal .... do | 185 | 167 |
| Manufactured iron .... do | .......... | 360 |
| Brick .... M | 100 | .......... |
| Clay .... tons | .......... | 270 |
| Flaxseed .... bushels | .......... | 2,200 |
| Miscellaneous merchandise .... tons | 506 | 206 |
| Oil .... barrels | .......... | 75 |

*Statement of freight and passengers carried through the Portage Lake and Lake Superior canals 1903.*

| Bound up. | Tons. | Bound down. | Tons. |
|---|---|---|---|
| Coal: | | Copper | 59,635 |
| Hard | 101,429 | Grain | 5,374 |
| Soft | 1,025,301 | Wheat | 19,051 |
| Manufactured iron | 21,233 | Flour | 47,491 |
| Salt | 30,234 | Oil | 877 |
| Copper | 28,022 | Iron ore | 164,348 |
| Limestone | 38,080 | Pig iron | 5,880 |
| Oil | 4,678 | Lumber | 542,487 |
| Building stone | 8,129 | Flaxseed | 11,320 |
| Lumber | 19,016 | Stamp sand | 16,850 |
| Stamp sand | 1,680 | Manufactured iron | 300 |
| Miscellaneous merchandise | 152,738 | Coal, soft | 26,505 |
| | | Miscellaneous merchandise | 15,652 |
| Total | 1,430,540 | Total | 915,770 |
| Total down | 915,770 | | |
| Total through canals | 2,346,310 | | |
| Local estimated | 74,538 | | |
| Grand total | 2,420,848 | | |

| | |
|---|---|
| Passengers up | 16,770 |
| Passengers down | 16,080 |
| Total passengers up and down | 32,850 |

*Statistics of vessels passing through the upper canal (Portage Lake Ship canals) for calendar year 1903.*

| | Steam vessels. | | Sailing vessels. | |
|---|---|---|---|---|
| | Number. | Net tonnage. | Number. | Net tonnage. |
| Bound up | 1,214 | 1,150,840 | 476 | 284,057 |
| Bound down | 717 | 415,159 | 248 | 139,682 |

Total vessels, 2,658; total net tonnage, 1,989,738.

*Table showing estimated value of freight passing through Portage Lake Ship canals for the calendar year 1903.*

[Tons of 2,000 pounds.]

| Item. | | Quantity. | Unit price. | Valuation. |
|---|---|---|---|---|
| Coal: | | | | |
| Hard | tons | 101,429 | $6.25 | $633,931 |
| Soft | do | 1,052,158 | 4.00 | 4,208,632 |
| Flour | barrels | 474,909 | 4.50 | 2,137,090 |
| Flax | bushels | 406,485 | 1.09 | 443,069 |
| Wheat | do | 635,037 | .79 | 501,679 |
| Other grains | do | 297,914 | .48 | 142,999 |
| Manufactured iron | tons | 21,893 | 65.00 | 1,423,045 |
| Pig iron | do | 5,880 | 21.00 | 123,480 |
| Iron ore | do | 164,348 | 2.35 | 386,218 |
| Copper | do | 87,657 | 250.00 | 21,914,250 |
| Building stone | do | 23,294 | 7.00 | 163,058 |
| Limestone | do | 38,080 | 1.50 | 57,120 |
| Oils | barrels | 27,853 | 7.00 | 194,971 |
| Salt | do | 201,563 | .60 | 120,938 |
| Sand | cubic yards | 12,520 | .50 | 6,260 |
| Lumber | M feet | 297,898 | 15.37 | 4,578,692 |
| Logs | do | 17,787 | 12.00 | 213,444 |
| General merchandise | tons | 169,301 | 165.00 | 27,934,665 |
| Total | | | | 65,183,541 |

In the above table there is given a part of the local and the regular through business both ways through these canals. There is a large local business from one part of the Portage Lake to another and over in Torch Lake done by tugs with scows, booms, etc., transporting lumber, cord wood, hay, charcoal, etc., and also towing rafts of logs and timber, amounting in value to over $600,000. There is also considerable traffic done by small steamers running between different points around Portage Lake that do not make any reports unless they pass through the Portage River or the upper canal.

*Summary of expenditures made from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Portage Lake and Lake Superior canals, Michigan, during fiscal year 1904.*

| Date. | Office expenses. | Field service. | Miscellaneous. | Dredging. | Total. |
|---|---|---|---|---|---|
| 1903. | | | | | |
| August | $371.81 | $1,307.34 | $1,904.02 | | $3,583.17 |
| September | 37.61 | 103.55 | | $4,052.33 | 4,193.49 |
| October | 356.57 | 1,098.53 | | | 1,455.10 |
| November | 172.07 | 585.27 | | | 757.34 |
| December | 385.91 | 834.03 | 46.72 | | 1,266.66 |
| 1904. | | | | | |
| February | 235.17 | 360.70 | | | 595.87 |
| March | 301.23 | 347.00 | | | 648.23 |
| May | 567.00 | 877.83 | | | 1,444.83 |
| June | 236.95 | 763.70 | 554.66 | | 1,555.31 |
| Total | 2,664.82 | 6,277.95 | 2,505.40 | 4,052.33 | 15,500.00 |

## I I 8.

## IMPROVEMENT OF HARBOR AT MARQUETTE, MICHIGAN.

For a history of this harbor see Annual Report of the Chief of Engineers for 1901, page 2877, and earlier reports.

Under the provisions of the act of Congress approved June 13, 1902, and the sundry civil act of March 3, 1903, work has continued upon the construction of concrete superstructure in accordance with the authorized project.

A brief statement of the method of conducting the work is contained in the Report of the Chief of Engineers, United States Army, for 1903, Appendix K K, page 1821.

The superstructure now being built consists of concrete footing blocks on the harbor and lake sides, subaqueous concrete between the footing blocks, and superimposed monolithic blocks, 10 feet long, built in place. Amount of concrete in a regular monolithic block, 36.1 cubic yards. About 17,000 yards of concrete will be used in the entire work. Estimated cost of entire concrete superstructure, $232,936.71.

See diagram herewith showing a cross-section of the portion of the work now under construction.

The work during the past year has been in charge of F. L. Dever, United States assistant engineer. The following data are mainly abstracted from a report by Mr. Dever:

Since the resumption of work in June, 1903, there has been 750 linear feet of the old superstructure removed to 1 foot or more below low-water datum, 650 feet prepared for footing blocks by leveling the old wall timbers with shimming pieces and inserting stringers resting upon the old ties, a difficult and tedious process on account of working in 2 to 3 feet of water. Number of footing blocks set was 296. There was 680 linear feet of subaqueous concrete foundation prepared, with footing blocks and mass concrete deposited between the blocks.

Sixty monolithic concrete blocks were built in place, equal to 600 linear feet of breakwater.

There are 5.75 cubic yards of concrete in a linear foot of complete superstructure at the section now under construction.

The proportion of ingredients in the footing blocks and subaqueous concrete is 1 cubic foot crushed rock, one-half cubic foot sand, 20 pounds Portland cement, and in the monoliths 1 cubic foot crushed rock, one-half cubic foot sand, 16 pounds Portland cement.

The stone dust is retained in the crushed rock. Alpena Portland cement was used and found very satisfactory.

Mr. Dever states that the average tensile strength of 90 briquettes made in May, 1904, from samples taken from the footing-block concrete was as follows:

| | 5 days. | 7 days. | 14 days. | 28 days. |
|---|---|---|---|---|
| | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| In damp cloth | 399 | 436 | 471 | 484 |
| In water | 342 | 394 | 464 | 565 |

These tests, it will be noticed, were taken from batches of concrete just as it went into the work. The high degree of strength shown much exceeds that of standard specifications, and is very gratifying.

Following are some of the modifications adopted from time to time as the result of experience since the work was begun in 1895, but without changing the typical form of the original design:

1. Footing blocks have been molded on shore and placed with a derrick, so as to bring the foundation above water on the lake side, and later on the harbor side also, instead of depositing loose concrete in the water. The height of these blocks has been increased during the past year by 1 foot.

2. Pieces of rubble which were at first incorporated in the monolithic concrete were soon afterwards omitted.

3. Portland cement has been substituted for natural cement in the construction of the monoliths. (Portland cement has been used for subaqueous concrete from the first.)

4. A concrete mixer has been substituted for hand mixing in the last year.

5. A small locomotive and gondola cars are now used for transporting the concrete from the mixer, which is located near the shore end of the breakwater, to where it is deposited in the work. The average distance of this transportation in the past fiscal year was 1,800 feet.

See also current summary.

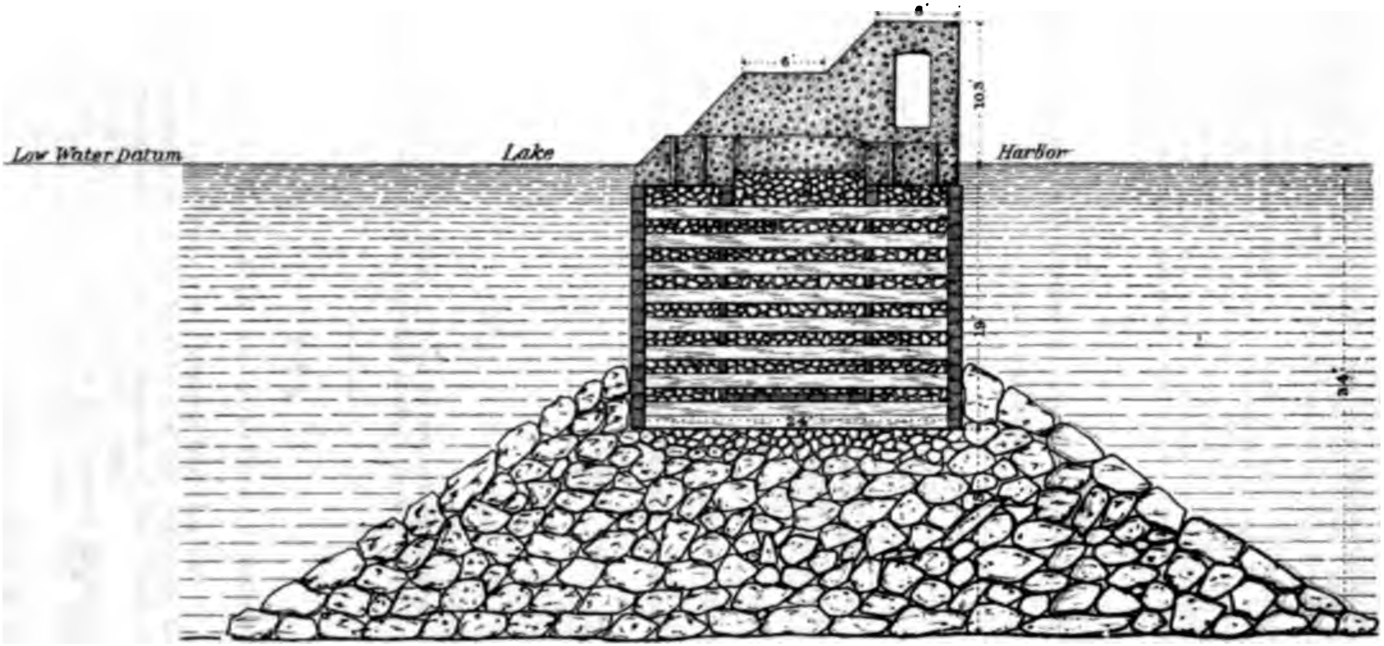
The available balance and appropriation asked for will be expended in the construction of concrete superstructure to its completion and for maintenance.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $95,275.93 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $50,171.80 | |
| For maintenance of improvement | 1,500.00 | |
| | | 51,671.80 |
| July 1, 1904, balance unexpended | | 43,604.13 |
| July 1, 1904, outstanding liabilities | | 5,000.00 |
| July 1, 1904, balance available | | 38,604.13 |
| July 1, 1904, amount covered by uncompleted contracts | | 8,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | | 5,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

### ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR AT MARQUETTE, MICH.

| | |
|---|---|
| By act of Congress— | |
| Approved March 2, 1867 (allotment) | $85,000.00 |
| Approved April 10, 1869 (allotment) | 26,730.00 |
| Approved July 11, 1870 | 25,000.00 |
| Approved March 3, 1871 | 60,000.00 |
| Approved June 10, 1872 | 50,000.00 |
| Approved March 3, 1873 | 15,000.00 |
| Approved June 23, 1874 | 15,000.00 |
| Approved March 3, 1875 | 15,000.00 |
| Approved June 18, 1878 | 2,000.00 |
| Approved August 14, 1878 | 2,000.00 |
| Approved March 3, 1879 | 1,500.00 |
| Approved June 14, 1880 | 1,000.00 |
| Passed August 2, 1882 | 16,000.00 |
| Approved July 5, 1884 | 5,000.00 |
| Approved August 5, 1886 | 10,000.00 |
| By act of Congress— | |
| Of August 11, 1888 | $25,000.00 |
| Approved September 19, 1890 | 40,000.00 |
| Approved July 13, 1892 | 80,000.00 |
| Of August 18, 1894 | 30,000.00 |
| Passed June 3, 1896 | 29,000.00 |
| Deposited in United States Treasury January 28, 1896 | 327.76 |
| July, 1898, repayment | .93 |
| Of March 3, 1899 | 25,000.00 |
| Approved June 13, 1902 | 26,000.00 |
| Sundry civil act March 3, 1903 | 80,000.00 |
| Total | 664,558.69 |



MARQUETTE BREAKWATER
With new concrete superstructure

Eng. 58 3

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

LIST OF EXISTING CONTRACTS.

Contract was entered into with Noah Pelissier, of Marquette, Mich., May 14, 1903, for furnishing sand for the concrete work, at 49 cents per cubic yard, approved by the Chief of Engineers May 25, 1903. Time of beginning work, May 15, 1903, and to be completed by September 1 1904.

Contract was entered into with F. B. Spear & Sons, of Marquette, Mich., dated February 15, 1904, approved by Chief of Engineers February 25, 1904, for delivering and piling in the United States warehouse at Marquette 4,300 barrels, more or less, of Portland cement, at $1.79 per barrel, delivered in barrels, and $1.89 per barrel delivered in sacks, including the sacks (4 sacks to the barrel), with a rebate of 10 cents per sack for each sack returned. Delivery to commence June 10, 1904, and complete August 10, 1904.

COMMERCIAL STATISTICS OF MARQUETTE, MICH. (INCLUDING PRESQUE ISLE, MICH.)

[Tons of 2,000 pounds.]

| Shipments. | Tons. | Receipts. | Tons. |
|---|---|---|---|
| Iron ore | 2,248,227 | Coke | 370 |
| Pig iron | 15,586 | Fish | 300 |
| Timber (500 M feet) | 1,000 | Coal | 371,212 |
| Lumber (16,750 M feet) | 25,095 | General merchandise | 12,100 |
| Lath (2,000,000 pieces) | 500 | Cement (13,500 barrels) | 2,700 |
| | | Oil (3,205 barrels) | 641 |
| Total | 2,290,408 | Brick (183 M) | [illegible] |
| | | Salt (2,100 barrels) | 300 |
| | | Total | 388,101 |

Total receipts and shipments, 2,678,509 tons; total valuation, $9,[illegible].

*Arrivals and departures of vessels, with registered tonnage, for calendar year 1903.*

| | Arrived. | Cleared. | Estimated tonnage. | Average tonnage. |
|---|---|---|---|---|
| Steam | 717 | 721 | | |
| Sail | 150 | 152 | | |
| Total | 867 | 873 | 2,792,92[illegible] | 1,[illegible] |
| Decrease | 107 | [illegible] | 216,[illegible] | [illegible] |

Total arrived and cleared, 1,740. These do not include the many boats which run into this harbor for shelter, nor the small boats in the fish trade.

## I I 9.

## HARBOR OF REFUGE, MARQUETTE BAY, MICHIGAN.

This harbor is also known as Presque Isle Harbor.

For the description of the locality and the interests to be benefited by the improvement see Annual Report of the Chief of Engineers, United States Army, 1896, pages [illegible].

For the work of improvement see the Annual Reports of the Chief of Engineers, United States Army, for years [illegible].
See also the current summary.

The approved projects were for building [illegible] feet of breakwater running out from Presque Isle Point, completed in [illegible], and extenward for closing a gap between said breakwater and the shore by cribwork 216 feet long (completed in 1902).

The work when last visited was in good condition, and affords great protection to the commercial business done in this bay. No additional work is proposed, except maintenance.

The available balance, with appropriation asked for, will be used for maintenance.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $409.42 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 200.00 |
| July 1, 1904, balance unexpended | 209.42 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 1,000.00 |

*Abstract of appropriations for harbor of refuge, Marquette Bay, Michigan.*

| Act of Congress— | |
|---|---|
| Passed June 3, 1896 | $20,000 |
| Approved March 3, 1899 | 30,000 |
| Approved June 13, 1902 | 7,500 |
| Total | 57,500 |

COMMERCIAL STATISTICS.

*Shipments from Presque Isle, Mich., for calendar year 1903.*

[Tons of 2,000 pounds.]

| | Tons. |
|---|---|
| Pig iron | 14,466 |
| Iron ore | 1,230,408 |
| Lumber (10,000,000 feet) | 15,000 |
| Lath (2,000,000) | 500 |
| Square timber (500,000 feet) | 1,000 |
| Total | 1,261,374 |

Approximate value of commerce, 1903, $3,379,445.
There were no receipts of freight by water.

*Arrivals and clearances of vessels for 1903.*

| Vessels. | Arrived. | Departed. | Total. |
|---|---|---|---|
| Steam | 318 | 318 | 636 |
| Sail | 64 | 64 | 128 |
| Total | 382 | 382 | 764 |

Estimated net registered tonnage, 1,400,000.

## I I 10.

## IMPROVEMENT OF HARBOR OF REFUGE AT GRAND MARAIS, MICHIGAN.

For a history of this harbor and the work of improvement by the Government see page 2880, Appendix K K, Report of the Chief of Engineers, United States Army, 1901, and earlier reports, including 1881, Appendix E E 4, page 2038, and 1871, page 131.

The contract work of pier extension, which was commenced May 4, 1903, and was under construction at the date of the last annual report, was completed December 1, 1903. Under this contract the west pier was extended 256 feet and the east pier was extended 192 feet, a total of 448 linear feet of pier work. The contract price of this pier work, including bearing piles and rock filling, was $91.26 per linear foot. There was also 2,698 tons of riprap placed at the base of the new piers, at $1.75 per ton of 2,000 pounds, making the cost of these extensions $45,605.98, which is $101.80 per linear foot. The bearing piles insure these new piers against settlement, to which the previously constructed piers, resting on brush mattresses, were subject. Under the same contract there were built 201 linear feet of superstructure to the old east pier, at $9.67—$1,943.67. The amount of this contract work was $47,549.65. There were also repairs to the piers made at a cost of $216.54.

The present length of the west pier is 1,912 feet, and of the east pier 1,545 feet. These lengths include 100 feet of pile pier at the inner end of each. The west pier is 344 feet farther into the lake than the east pier.

On account of sand movement the 22-foot curve of depth has advanced lakeward between four and five hundred feet since the project for improvement was adopted, and this fact will entail some additional expense for pier extension to deep water.[a]

It is important that the pier extensions be completed in order to prevent shoaling in the entrance channel.

The last dredging was in 1891, leaving a least depth of 17 feet for a width of 175 feet. When last examined (in May, 1904) the least depth in mid-channel was 13 feet at low-water datum.

A contract for deepening the channel has been made, and work on same began June 25, 1904. Up to June 30, 1904, 10,133 yards had been removed. A total of about 40,000 yards is to be dredged, and this is expected to result in a channel with a least depth of 17 feet at low-water datum and a width of about 300 feet. This work is to be completed by July 31, 1904.

The pile dike which closes the natural entrance was built in 1895-1897 to prevent the wearing away of the narrow sand spit which extended to the east of the artificial entrance and arrest the movement of sand from the east, both of which agencies were gradually advancing sand bars into the harbor basin. It was also expected that with the dike in place, the sand brought by wave action from the easterly shore would be distributed along the dike and form a permanent sand spit. These objects have been partially realized, and a ridge of sand has been formed along the easterly portion of the dike and is slowly forming farther west. The dike is, however, failing from age, and a large body of ice which piled upon it last winter destroyed about 100 feet of it at a point about 1,800 feet from the west end.

---

[a] This will be made the subject of a special report later.

This break will be closed with an embankment of riprap, and a portion of the adjoining dike (900 feet, more or less) will be strengthened by depositing an embankment of rock against it on the harbor side, to the extent of available funds, including an allotment of $5,000 from the emergency appropriation of act approved June 13, 1902. The maintenance of the dike will make it necessary to strengthen more of the dike in the above manner or otherwise, amounting to possibly 2,600 linear feet in all, or 45 per cent of the entire length.

It is proposed to apply the available balance and appropriation recommended to the work of pier extension, dredging in the entrance channel, repairs to the pile dike, and maintenance.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $67,283.75 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | | 5,000.00 |
| | | 72,283.75 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $48,680.11 | |
| For maintenance of improvement | 1,000.00 | |
| | | 49,680.11 |
| July 1, 1904, balance unexpended | | 22,603.64 |
| July 1, 1904, amount covered by uncompleted contracts | | 8,000.00 |
| Amount (estimated) required for completion of existing project | | 83,401.68 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $83,401.68 | |
| For maintenance of improvement | 40,000.00 | |
| | | 123,401.68 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

ABSTRACT OF APPROPRIATIONS FOR IMPROVING HARBOR OF REFUGE AT GRAND MARAIS, MICH.

| | |
|---|---|
| By act of Congress— | |
| Approved June 14, 1880 | $10,000.00 |
| Approved March 3, 1881 | 20,000.00 |
| Passed August 2, 1882 | 40,000.00 |
| Approved July 5, 1884 | 35,000.00 |
| Approved August 5, 1886 | 26,250.00 |
| Of August 11, 1888 | 50,000.00 |
| Approved September 19, 1890 | 50,000.00 |
| Approved July 13, 1892 | 30,000.00 |
| Of August 18, 1894 | 20,000.00 |
| Passed June 3, 1896 | 24,000.00 |
| By act of Congress— | |
| Approved March 3, 1899 | $25,000.00 |
| Allotted from act June 6, 1900 | 384.32 |
| Approved June 13, 1902 | 70,000.00 |
| Sale of United States property | 125.00 |
| Allotted from act June 13, 1902 | 5,000.00 |
| Total | 405,723.32 |

### EXISTING CONTRACT.

Contract was entered into March 28, 1904, with Lake Superior Contracting and Dredging Company, of Duluth, Minn., and approved by Chief of Engineers, April 9, 1904, for dredging 40,000 cubic yards, more or less, in removing shoals between the piers, etc., at 17 cents per cubic yard, scow measurement, work to begin by June 1, 1904, and be completed by July 31, 1904.

### COMMERCIAL STATISTICS.

*Arrivals and clearances of vessels at Grand Marais, Mich., 1903.*

| | Arrived. | Departed. | Total. | Net registered tonnage. |
|---|---|---|---|---|
| Steam | 300 | 300 | 600 | 480,000 |
| Sail or tow | 100 | 100 | 200 | 160,000 |
| Total | 400 | 400 | 800 | 640,000 |

*Principal articles received and shipped, 1903.*

| Shipments. | Tons. | Receipts. | Tons. |
|---|---|---|---|
| Lumber (40,000,000 feet) | 60,000 | Merchandise | 5,000 |
| Shingles (20,000 M) | 2,000 | Coal | 3,000 |
| Laths (8,800 M) | 2,200 | Logs (727,000 feet) | 4,000 |
| Fish | 250 | Lumber (667,000 feet) | 1,000 |
| Ties (59,400) | 3,300 | | |
| Miscellaneous merchandise | 250 | | |
| Total | 68,000 | Total | 13,000 |
| Valuation | $768,948 | Valuation | $855,876 |

Total freight, 81,000 tons.
Approximate value of commerce, $1,624,824.

## I I II.

## REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

On September 19, 1903, the steamer *A. A. Parker* foundered in Lake Superior off Grand Marais, Mich.

The location of the wreck, some 4 or 5 miles from the harbor, was swept without finding any obstruction, the wreck having probably sunk in a sandy bottom. It is improbable that the wreck forms any obstruction to navigation, and the expense of continuing the search until it could be found would probably have been out of proportion to the benefits to be derived from the information to be received.

Captain Truedell, of the United States Life-Saving Service, kindly volunteered the services of himself and crew of five men and a surf boat, and rendered valuable assistance to the United States inspector on the Grand Marais pier work in the search for the wreck. In addition, a gasoline launch was used at an expense of $45.

On November 29, 1903, the steamer *J. T. Hutchinson* struck a reef about 6 miles west of Eagle River in Lake Superior and 1 mile from shore. The boat and a portion of its cargo were removed from the reef on December 7th, taken to Hancock, and the vessel temporarily patched for the rest of its journey.

An attempt was made on the 9th of December to make a survey at the location of the reef on which the steamer stranded, but this proved a failure on account of the depth of snow on land and the formation of ice on the water, causing the buoy at the location of the wreck to sink, and the work was given up. An expense of $72.24 was incurred on account of this work, and for several other minor items relating to wrecks.

An allotment of $200 from the indefinite appropriation for "Survey of Northern and Northwestern Lakes" was made in May, 1904, for locating the reef on which the steamer *J. T. Hutchinson* stranded, and this work is now being laid out, and will be completed during July, 1904.

## RÉSUMÉ.

*Cost of operations on each work, both for fiscal year ending June 30, 1904, and since the commencement of operations, with total vessel freight and estimated value of same.*

| Name of work. | Amount expended during fiscal year ending June 30, 1904. | Vessel freight, 1903. | | Date of commencement of improvement by the United States. | Total amount expended by United States to June 30, 1904. | Vessel freight from commencement of work to Jan. 1, 1904. | |
|---|---|---|---|---|---|---|---|
| | | Tons of 2,000 pounds. | Estimated value. | | | Tons of 2,000 pounds. | Estimated value. |
| Grand Marais, Minn.. | $1,739.66 | 35,255 | $732,137 | 1880 | $165,033.59 | 115,147 | $3,797,976 |
| Agate Bay, Minn..... | 257.50 | 5,986,759 | 15,042,922 | 1887 | 244,415.56 | 45,079,518 | 94,188,900 |
| Duluth-Superior...... | 176,060.48 | [a]17,966,718 | 177,744,956 | 1867 | 4,638,528.77 | 138,930,884 | 1,986,847,470 |
| Portwing, Wis ....... | 20,694.71 | 51,969 | 785,054 | 1903 | 21,476.07 | 124,119 | 1,743,454 |
| Ashland, Wis.......... | 28,947.68 | [b]4,212,386 | 20,904,856 | 1887 | 304,646.24 | 51,830,948 | 424,563,922 |
| Ontonagon, Mich .... | 4,821.51 | [c]7,990 | 523,870 | 1867 | 849,792.64 | 2,718,854 | 71,889,524 |
| Waterway across Keweenaw Point...... | 8,803.40 | [d][e]2,420,848 | 65,188,541 | 1891 | 1,295,237.68 | 16,355,768 | 513,474,260 |
| Operating and care of same ............... | 15,500.00 | ............ | ............ | 1891 | 136,557.64 | ............ | ............ |
| Marquette, Mich ..... | 51,671.80 | [f]2,678,509 | [g]9,696,631 | 1867 | 620,954.56 | [f]28,169,285 | [g]130,717,931 |
| Harbor of refuge, Marquette Bay ..... | 200.00 | (1,261,374) | (3,379,445) | 1897 | 49,790.58 | (10,115,990) | (25,005,316) |
| Grand Marais, Mich.. | 49,680.11 | [h]81,000 | 1,624,824 | 1880 | 383,119.68 | 1,078,299 | 13,915,591 |
| Total ........... | 358,376.85 | 33,441,434 | 292,238,291 | ........ | 8,209,553.01 | 284,397,822 | 3,241,139,028 |

[a], [b], [c], [d] do not include logs, as follows: [a] 81,125,000 feet; [b] 250,000,000 feet; [c] 2,400,000 feet; [d] 17,787,000 feet.

[e] Largely freight passing through the canals.

[f] and [g] include Marquette Bay.

[h] Includes logs.

## I I 12.

## PRELIMINARY EXAMINATION OF HARBOR AT GRAND MARAIS, MINNESOTA, WITH A VIEW TO ASCERTAINING THE NECESSITY OF MAKING ANY CHANGE OR ADDITION TO THE EAST PIER.

[Printed in House Doc. No. 218, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington*, *December 1, 1903.*

Sir: I have the honor to submit herewith for transmission to Congress a report dated January 17, 1903, by Capt. David D. Gaillard, Corps of Engineers, giving the results of a preliminary examination authorized by the river and harbor act approved June 13, 1902, of the harbor at Grand Marais, Minn., "with a view to ascertaining the necessity of making any change in or addition to the east pier."

For reasons stated therein Captain Gaillard does not consider it advisable at the present time to recommend any such change or addition. The division engineer, Col. O. H. Ernst, Corps of Engineers, concurs in his opinion.

This report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and a committee of the Board has visited the locality. Attention is respectfully invited to the Board's report of April 9, 1903, in third indorsement thereon.

Grand Marais Harbor has been improved by the General Government by dredging and the construction of breakwaters to provide a harbor of refuge, and the object of the present investigation is to ascertain the necessity of additional work on the east pier. In the opinion of the Board present commerce is sufficiently provided for by existing works, and I concur in its conclusion that at this time it is not desirable for the United States to undertake the further improvement of this locality.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### REPORT OF CAPT. D. D. GAILLARD, CORPS OF ENGINEERS.

United States Engineer Office,
*Duluth, Minn., January 17, 1903.*

General: In compliance with Department letters of June 23 and July 3, 1902, I have the honor to submit the following report upon the preliminary examination of "Grand Marais [Minn.], with a view to ascertaining the necessity of making any change in or addition to the east pier."

The harbor at Grand Marais, Minn., is an elliptical bay whose major axis is about one-half mile, and whose minor axis is about one-fourth of a mile in length. Protection is given by two breakwater piers, each 350 feet long, from the east and west points of the bay. These piers have been completed, and an aggregate area of 26 acres dredged to a depth of at least 16 feet, all as contemplated in the project and at a cost of $163,954.63.

This harbor is the only harbor of refuge on the north shore between Two Harbors (Agate Bay) and the international boundary line. Its improvement was commenced in 1880, and the project was completed in 1901. The harbor is a small one, its total capacity, after future dredging, being about 61 acres.

Owing to the fact that the west pier projects so much farther south than the east pier, and to the existence of a large shoal area within 450 feet of the entrance, vessels experience more difficulty in entering the harbor during northeast storms than they did previous to the construction of the west breakwater.

The remedy for this condition of affairs would be the construction of a new east pier about 350 feet in length in prolongation of the rocky reef, and at an angle of about 45° with the present east pier, in removing a part of the old east pier, and in dredging away about 9 acres of the shoal area near the entrance, previously described. The estimated cost of construction of the new east pier, and of removing a part of the old east pier, is about $40,000. That of the dredging, involving the removal of about 122,000 cubic yards, is about $28,000.

No railroads lead to Grand Marais, and inhabitants of the vicinity are totally dependent upon water transportation for their receipts and shipments.

The commerce of the port has been steadily increasing during recent years, the receipts and shipments for the calendar year 1901 being as follows:

*Freight received and shipped, 1901.*

| | | |
|---|---|---|
| Receipts: | | |
| Hay | tons of 2,000 pounds.. | 111 |
| Oats | do.... | 67 |
| Manufactured lumber | do.... | 276 |
| Laths and shingles | do.... | 441 |
| Cement and lime | do.... | 16 |
| Flour and mill stuffs | do.... | 99 |
| Brick | do.... | 224 |
| Miscellaneous merchandise | do.... | 310 |
| Total | do.... | 1,544 |
| Shipments: | | |
| Railroad ties | do.... | 5,833 |
| Telegraph poles | do.... | 8,125 |
| Pulp wood | do.... | 8,550 |
| Fish | do.... | 64 |
| Miscellaneous merchandise | do.... | 2 |
| Total | do.... | [a] 22,574 |

| | | |
|---|---|---|
| **Passengers:** | | |
| Arriving | number.. | 918 |
| Departing | do.... | 919 |
| Total | do.... | 1,837 |
| Valuation of receipts and shipments, 1901 | | [a]$249,144 |

The commerce of the port is well protected by present improvements, which are in fair condition, the only difficulty being the risk of entering during northeast storms, for the reasons previously stated. So far as I can learn, no vessels have suffered injury in making the entrance since the completion of the west breakwater in August, 1901. The progress of development of the north shore, however, has been very great in recent years, and any large increase in the commerce of the port or in the size of the vessels entering it would render a change in existing conditions desirable. The first and most important remedy would be the dredging previously described, but the act approved June 13, 1902 (Public, No. 154), limits this preliminary examination to any change in, or addition to, the east pier, and therefore eliminates any recommendation in reference to dredging. Without the dredging a change in the location of the east pier, while beneficial, would not attain the desired result, and as present conditions are fairly satisfactory I do not consider it advisable at the present time to recommend any change in or addition to the east pier.

Rich mineral deposits are alleged to exist in the back country. Should these be opened up and connected with the lake by railroad, the harbor would become of considerable importance as an ore-shipping point.

Respectfully submitted.

D. D. Gaillard,
*Captain of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Office Division Engineer, Northwest Division,
*Chicago, Ill., January 19, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that no change in or addition to the east pier is at present necessary.

O. H. Ernst,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

Office Chief of Engineers, U. S. Army,
*February 11, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

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[a] Not including 7,000,000 feet of logs.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 9, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer, the indorsement of the division engineer thereon, and several letters from interested persons.

Present commerce is sufficiently provided for by existing works. In the opinion of the Board there will be no increase in the commerce of the locality sufficient to justify expenditure for further improvement until interior ore and timber lands have been developed and connected with the port by rail. In the event of such development it may become advisable to alter materially the existing project, but at present the Board believes that it is not desirable for the United States to undertake the further improvement of the harbor of Grand Marais, Minn.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## I I 13.

## PRELIMINARY EXAMINATION AND SURVEY OF MARQUETTE HARBOR AND VICINITY, MICHIGAN.

[Printed in House Doc. No. 161, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: The river and harbor act approved June 13, 1902, makes provision for a preliminary examination and a survey of Marquette Harbor, Michigan, and vicinity, "with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point." In pursuance of this provision, I have the honor to submit herewith for transmission to Congress reports dated January 17, 1903, by Capt. D. D. Gaillard, Corps of Engineers, upon preliminary examination, and September 30, 1903, by Capt. Chas. L. Potter, Corps of Engineers, upon survey, with indorsements thereon by the division engineer, Col. O. H. Ernst, Corps of Engineers, and by the Board of Engineers for Rivers and Harbors, to which these reports were referred for consideration and recommendation, as provided by sections 3 and 14 of said act of June 13, 1902.

The Board concurs in the opinion expressed by the district officers and the division engineer that greater harbor of refuge facilities are needed in this vicinity; that Marquette Harbor is the best place to select for improvement to this end, and that the sheltered area needed can be secured by extending the present breakwater. The estimated cost of extending this breakwater 1,500 feet is $303,000. In the opinion of the Board this expenditure is reasonable when compared to the advantages to commerce that would follow its construction, and the locality is therefore regarded as worthy of improvement by the United States in the manner proposed.

In this opinion I concur.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF MARQUETTE HARBOR AND VICINITY, MICHIGAN.

UNITED STATES ENGINEER OFFICE,
*Duluth, Minn., January 17, 1903.*

GENERAL: In compliance with Department letters of June 23 and July 3, 1902, I have the honor to submit the following report upon the preliminary examination of "Marquette Harbor and vicinity, with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point."

There are two harbors now available at Marquette, Mich., one of them being known officially as the harbor at Marquette, Mich., and the other as the harbor of refuge, Marquette Bay, Michigan. These harbors are but 2¾ miles apart, and the latter, although called a harbor of refuge, was built solely to afford protection to the terminal docks for an ore-shipping railroad. It is not used as a harbor of refuge, for in very severe storms vessels can not lie in it in safety.

A third site has been suggested for the construction of a harbor of refuge in case additional facilities are needed of this description in the vicinity of Marquette. This is Partridge Bay, lying to the west of Partridge Island. All of the localities mentioned are shown on Lake Survey chart No. 120, chart of Marquette and Presque Isle harbors, Michigan.

A study of the various interests involved shows that if further harbor of refuge facilities are needed they can best and most economically be secured by prolonging the present breakwater at the harbor at Marquette. This breakwater is 3,000 feet in length and was completed in 1894, at a total cost of $469,732.44, including repairs. Owing to the decay of the original timber superstructure about 1,500 feet of this superstructure has been replaced by concrete. Under authority granted by the act approved June 13, 1902. It is proposed to complete the remaining [illegible] feet of concrete superstructure during the seasons of 1903–4.

The present breakwater shelters wholly, or in part, an area of about 300 acres, of which about 125 acres has a greater depth than 18 feet.

The distance to the nearest points of shelter for vessels in case of storms is to the east [illegible] miles to South Bay behind Grand Island, and to the west [illegible] miles to the mouth of Portage River. The distance of Marquette Harbor from the sailing course of vessels from the Sault to the head of the lake and around Keweenaw Point is [illegible] miles; from the Sault to Portage River, [illegible] miles; and from Grand Island to Portage River, [illegible] miles.

During prolonged storms large numbers of vessels take refuge in this harbor. The United States watchman states that during the past two years he has counted 32 vessels lying in the harbor at one time, and that they were so closely packed and experienced such difficulty from the dragging of anchors due to the great congestion which prevails in the harbor at such times that tugs were kept busy all night trying to avert damage to the vessels.

If the present breakwater were extended 1,500 feet, it would add about 120 acres to the total sheltered area, of which about 80 acres would be in water deeper than 18 feet at low-water datum (601.6 feet above mean tide, New York). This would also shelter the largest ore dock in the harbor, ore dock No. 1, which is now very imperfectly protected by the present breakwater.

During the five years, 1897 to 1901, inclusive, the total vessel freight arrived and departed at Marquette Harbor was 13,796,558 tons, and at harbor of refuge, Marquette Bay (2½ miles distant), [illegible] tons. Of this amount 2,990,591 tons of 2,000 pounds each, valued at $[illegible],921,434, were handled in 1901 at Marquette Harbor, and [illegible] tons, valued at $4,153,545, were handled at harbor of refuge, Marquette Bay, in 1901. The figures for 1902 are not available, but it is known that they will considerably exceed those for 1901—probably reaching about 5,000,000 tons for Marquette's two ports.

In view of the large yearly increase in shipping on Lake Superior, and of the fact that at times the harbor is badly crowded, I am of the opinion that further harbor of refuge facilities are needed at Marquette Harbor, and that they should be secured by extending the present breakwater for a distance of about 1,500 feet. It is not believed that any survey will be necessary, but it is respectfully recommended that an allotment of $150 be made for the preparation of plans and estimates and a report of the cost of the improvement.

Respectfully submitted.

D. D. GAILLARD,
*Captain of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 19, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that additional facilities for the shelter of vessels during storms are needed at Marquette, and that the best way to secure them is to extend the present breakwater at the harbor of Marquette.

The request for an allotment of $150 for the preparation of plans and estimates is recommended for approval.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 19, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer and the indorsement of the division engineer thereon.

Both the present and prospective commerce involved is large and general in its character, and is in need of more shelter in time of storms than is now afforded by the harbors in the vicinity.

The Board concurs in the opinion expressed by the district officer and division engineer that greater harbor of refuge facilities are needed in this vicinity; that Marquette Harbor is the best place to select for improvement to this end, and that the sheltered area needed can be secured by extending the present breakwater.

In the opinion of the Board it is desirable for the United States to undertake this improvement, provided it can be made at reasonable cost.

The Board therefore recommends that there be made an allotment of $150, as requested by the district officer, for the preparation of plans and estimate of cost.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*March 26, 1903.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Marquette Harbor and vicinity, Michigan, authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend the preparation of plan and estimate of cost of improvement of the locality, as proposed, be authorized.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Fifth indorsement.]

WAR DEPARTMENT,
*March 28, 1903.*

Approved as recommended by the Acting Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, October 8, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report containing plans and estimates as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 12, 1903.*

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has considered the accompanying report of the district officer containing a project and an estimate of cost of extending the Marquette breakwater 1,500 feet, and a full exposition of the commercial benefits to result from such an extension, both as regards the general commerce of the lake by an increase of harbor of refuge facilities and as regards the commerce of the port of Marquette.

In third indorsement hereon the Board expressed the opinion that the desirability of the proposed improvement hinged upon its cost. In comparison with the advantages to commerce that would follow the execution of the proposed work, the Board believes that the expenditure involved, $303,000, is reasonable.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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SURVEY OF MARQUETTE HARBOR, MICHIGAN.

DULUTH, MINN., *September 30, 1903.*

GENERAL: I have the honor to make the following report on the rvey of harbor at Marquette, Mich., and submit plan and estimate r further improvement of the same.

2. Section 14 of the river and harbor act of June 13, 1902, provided

for a preliminary examination of "Marquette Harbor and vicinity, with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point."

3. By direction of the Chief of Engineers, a preliminary examination was made by Capt. D. D. Gaillard, Corps of Engineers, and his report submitted January 17, 1903, states:

> In view of the large yearly increase in shipping on Lake Superior, and of the fact that at times the harbor is badly crowded, I am of the opinion that further harbor of refuge facilities are needed at Marquette Harbor, and that they should be secured by extending the present breakwater for a distance of about 1,500 feet.

4. By direction of the Chief of Engineers, contained in letter of April 1, 1903, the survey and estimates have been made.

5. Marquette Harbor has long been an important harbor for commerce, steadily increasing in that respect, and has also for several years been used quite extensively as a harbor of refuge. Its importance in the latter respect has been very materially enhanced in recent years by the improvement of the Portage Lake ship canals across Keweenaw Point, causing a much larger portion of the lake commerce to take advantage of that canal, and thus run much nearer to Marquette Harbor in their regular course than they did formerly in passing outside of this point. It has been reported, unofficially, that there have been counted 32 vessels at one time taking advantage of this harbor as a harbor of refuge, and, while no accidents were reported, it is stated that the space was pretty well filled.

6. Considering the fact that the harbor area is by no means perfectly protected, and it has already been taxed to near its limit, and that there is no other place so convenient between Whitefish Point and the Portage Lake Canal, it seems to me to be plain that "further harbor of refuge facilities are needed" in this vicinity, and that the best point is Marquette Harbor.

7. The commerce of Marquette Harbor has been gradually increasing, as is shown by the following table showing the total receipts and shipments for the part seven years:

| Year. | Vessel freight. |
|---|---|
| | *Short tons.* |
| 1896 | 1,832,061 |
| 1897 | 2,529,518 |
| 1898 | 2,491,467 |
| 1899 | 2,919,339 |
| 1900 | 2,937,058 |
| 1901 | 2,889,501 |
| 1902 | 3,110,709 |

8. While the present harbor facilities are enough to accomodate this commerce, the protection afforded shipping is by no means perfect, and the extension of the breakwater would, in addition to providing more harbor of refuge area, greatly benefit the present commerce. There is no reason to believe that there will not be a steady increase in the commerce of this harbor.

Regarding the conditions in this harbor during severe storms, Mr. Clarence Coleman, assistant engineer, has submitted to me the following memorandum, dated September 25, 1903:

> I was stationed at Marquette, Mich., in local charge of the construction of the concrete superstructure to the breakwater, from May, 1895, to May, 1898. I observed that during the stormy seasons the harbor was much used as a harbor of refuge. The harbor, as at present protected, is subject to very violent undertow, and vessels

> seeking refuge during storms sometimes have great difficulty in holding with their anchors. During a storm which occurred on November 7, 1897, I saw the water on the north beach, about 700 feet west of the north end of the breakwater, surge back and forth over 90 feet, measured on the horizontal; that is to say, the undulations caused a change in the shore line of 90 feet at this point. The same night at the same locality I worked until 2 a. m. attempting to hold two scows. I had 1,200 feet of new 1½-inch diameter manila line, and with a good crew of men, assisted by the United States life-saving crew, I found it was impossible to hold them, as they broke the lines as quickly as we made them fast. I am of the opinion that the permanent importance of Marquette Harbor is in its position as a harbor of refuge, and while I never saw it crowded beyond its capacity with vessels seeking refuge during my residence at Marquette, yet it is no unreasonable assumption to suppose that such a condition might very readily occur.
>
> It would seem that the present harbor is inadequately protected or such conditions of undertow as those described would not exist, and any improvement or extension of the breakwater that would not only increase the harbor area, but at the same time mitigate the evil of undertow, would add much to its utility as a harbor of refuge.

Captain Benson, master of a large tug formerly employed at Marquette, states that a decided undertow is felt at the wharves, causing loaded vessels to range on their lines, frequently parting them.

9. It has been suggested that the harbor area might be increased by dredging at a less cost, but this would not do away with the present trouble from undertow, and it appears that the present breakwater should be extended to overcome this difficulty, and afterwards dredging could be resorted to if the available area should not be sufficiently large.

10. A map of Marquette Harbor showing two locations of the proposed extension is submitted herewith. Of these two locations it is thought better to build on the line of the old breakwater extended. The extension of this line 1,500 feet should give safe protection from undertow, will increase the protected area outside of harbor lines to about 162 acres, as against 88 now protected, and this could afterwards be increased to 172 by dredging, while the oblique position will give only 152 acres, or 162 with dredging. It should give perfect safety to vessels lying at ore dock No. 1, which is now denied them; it will give sufficient space for vessels coming around the end of the breakwater to head up toward the harbor basin without interfering with vessels approaching or leaving this ore dock; it gives a good location for the harbor entrance in case the harbor should ever become of sufficient importance to warrant the construction of a breakwater out from the south shore to inclose more area for commerce, and the cost will be less than 12 per cent additional over the 1,200 feet on the oblique line.

11. I therefore recommend the extension of the present breakwater 1,500 feet, at an estimated cost of $303,000.

12. Report on the survey made by Assistant Engineer F. L. Dever, in local charge of work at Marquette, is submitted herewith, showing estimate of cost of improvement in detail. Also map of Marquette Harbor, showing plan and method of construction of proposed extension, the latter being only a general method of construction, which may be varied in case the work be undertaken.

* * * * * * *

Respectfully submitted.

CHAS. L. POTTER,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
ough the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., October 3, 1903.*

Respectfully forwarded to the Chief of Engineers. I concur in the recommendation contained in paragraph 11.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

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### REPORT OF MR. F. L. DEVER, ASSISTANT ENGINEER.

MARQUETTE, MICH., *September 15, 1903.*

CAPTAIN: I have the honor to report that in compliance with Department letter dated April 1, 1903, a survey for the extension of the breakwater at Marquette Harbor, Michigan, has been executed, and projects for the improvement suggested for your consideration, with estimates of cost, based upon the results of the survey.

*Survey.*—This was made by Mr. Chas. Carisch, junior engineer, under my immediate direction, in the months of May and June, 1903. This was not a full survey of the harbor. Only the vicinity of the present breakwater and suggested locations of the proposed extensions was included in the survey.

A base line was accurately measured on top of the concrete superstructure to the present breakwater and seven triangulation stations were established, of which four are of a permanent nature and were well marked. Observations were taken on Polaris for determining the true meridian.

Soundings were taken from a rowboat run on located ranges, and position on range was located by transit intersections.

Gauge readings were taken for reducing the soundings to low-water datum.

The gauge was checked by spirit levels from old-established bench marks and comparison of readings with the United States gauges on ore dock No. 4 in Marquette Harbor.

A map of Marquette Harbor, made from this and previous surveys, is transmitted herewith.

*Project for improvement.*—The project for the improvement to obtain greater harbor of refuge facilities contemplates the extension of the present breakwater.

It might also include the dredging out of the shoal area at north end of the present harbor. The removal of about 65,000 cubic yards of material by dredging at a cost of about $15,000, would increase the area with a depth of 20 feet or more, protected by the present breakwater by about 10 acres.

In the project for the extension of the present breakwater to obtain greater harbor of refuge facilities, two locations for the extension are suggested for your consideration; one in a southeasterly direction from the end of the present breakwater, designated location A–B, and the other one on the prolongation of the line of the present breakwater, designated location A–C.

It is believed that either of these locations would answer the requirements. The greatest exposure is from the north and northeast storms, and these have to be provided against. Northwest storms cause more or less "dead swells," and result in considerable disturbance in the harbor.

It is found from the official records of the United States Weather Bureau at Marquette, Mich., that the wind has attained a maximum velocity of 33 miles per hour from the northeast on three occasions during the past ten years, and that it has exceeded 25 miles per hour twenty-two times during that period. The maximum from the north was 38 miles an hour, and the maximum from the east the same. Winds from the east to the southeast could not produce any very heavy swells, owing to the short stretch to the south shore in that direction.

Location A–B would give a safer entrance to the harbor by allowing the vessel to keep farther away from shore on southwest side of the bay and by giving a greater sheltered width in which to swing around and head into the wind before anchoring. The vessels entering the harbor at the time of a northeast storm approach the end of the present breakwater on very nearly a west course and run very close to the end. (In fact, so close that one vessel ran into the end of the breakwater the past summer. Name of vessel or exact date unknown. Damage slight.) Vessel masters have a great abhorrence for the southwest shore of the bay and for the shore in the vicinity of the mouth of Chocolay River, as a result of the great number of wrecks and casualties which have occurred in said localities in the past, and they keep away from the shore as far as possible.

The present breakwater protects an area of about 88 acres,[a] with an available depth of 20 feet or more during moderate northeast storms. The removal of some 65,000 cubic yards of material by dredging would increase this area to about 98 acres. The harbor area would be increased by about 64 acres by building 1,200 feet of breakwater on location A-B, making the total area 162 acres outside harbor lines, which would be well protected during moderate northeast storms; or by building 1,500 feet of breakwater on location A-C the harbor area would be increased by about 74 acres, making the total area 172 acres outside harbor lines, which would be well protected during moderate northeast storms.

*Kind of breakwater.*—The kind believed to be best suited to the conditions at Marquette Harbor is timber cribs resting upon a pile foundation and stone embankment, and a superstructure of concrete similar in form to that being built on the old wooden cribs of the present breakwater. The foundation and the cross section of timber crib and concrete superstructure should be designed with regard to stability and economy.

Suggested cross sections of the breakwater for the two locations are shown on the map. It is believed the stability of a breakwater of the section shown would be ample to withstand the heaviest storms of this locality. In my opinion, the greatest danger at location A-B would be from ice pressure at time of heavy northeast storms with a large body of ice outside the breakwater. With a sloping face, reaching 2 feet below low-water datum, it is believed that the danger from this source would be no greater than it is at the southerly end of the present breakwater, if as great. The stability to prevent displacement by sliding laterally could be greatly increased at a slight cost, and is provided for in the estimate of cost.

*Estimate of cost.*—The following estimate is for 50 linear feet, complete, of average section of embankment, and for a pierhead 100 feet in length. The prices for pile foundation, riprap embankment, and crib are intended to represent the probable cost of material in place, together with contractors' profits and insurance against risks, etc. The prices for concrete in place are intended to represent the probable cost for the United States to do the work by hired labor, using plant, equipment, etc., on hand after concrete superstructure to the present breakwater is completed.

### *Estimate for location A-B.*

FOUNDATION AND CRIB.

| | | | |
|---|---|---|---|
| Piling, 3,380 linear feet, at 15 cents | | $507.00 | |
| Riprap embankment, 1,990 cubic yards, at $1.40 | | 2,786.00 | |
| Pine timber, 83,300 feet B. M., at $28 | | 2,332.40 | |
| Iron fastenings, 5,800 pounds, at 3¼ cents | | 188.50 | |
| Stone ballast, 720 cubic yards, at $1.60 | | 1,152.00 | |
| Concrete, 24 cubic yards, at $7 | | 168.00 | |
| Steel plate and fastenings, 7,450 pounds, at 3½ cents | | 260.75 | |
| | | 7,394.65 | |
| Superintendence, inspection, etc., 10 per cent | | 739.46 | |
| | | | $8,134.11 |

CONCRETE SUPERSTRUCTURE.

| | | | |
|---|---|---|---|
| Footing blocks in place, 62.5 cubic yards, at $10.50 | | 656.25 | |
| Monolithic blocks in place, 239.3 cubic yards, at $6.50 | | 1,555.45 | |
| Railroad track, ties, etc | | 20.00 | |
| | | 2,231.70 | |
| Superintendence, inspection, etc., 10 per cent | $223.17 | | |
| Unforeseen incidentals, accidents, etc., 5 per cent | 111.58 | | |
| | | 334.75 | |
| | | | 2,566.45 |
| Total for 50 feet complete | | | 10,700.56 |
| Cost, per linear foot | | | 214.01 |

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[a] This is outside the harbor line—that is, between the harbor line and the breakwater—and does not include the areas within the harbor line.

### PIERHEAD.

| | | | |
|---|---|---|---|
| Piling, 14,040 linear feet, at 15 cents | | $2,106.00 | |
| Riprap embankment, 6,800 cubic yards, at $1.40 | | 9,520.00 | |
| Pine timber, 224,000 feet B. M., at $28 | | 6,272.00 | |
| Iron fastenings, 15,000 pounds, at 3¼ cents | | 487.50 | |
| Stone ballast, 2,050 cubic yards, at $1.60 | | 3,280.00 | |
| Steel plate and fastenings, 20,250 pounds, at 3½ cents | | 708.75 | |
| | | 22,374.25 | |
| Superintendence, inspection, etc., 10 per cent | | 2,237.42 | |
| | | | $24,611.67 |

### CONCRETE SUPERSTRUCTURE.

| | | | |
|---|---|---|---|
| Footing blocks in place, 140 cubic yards, at $11.25 | | 1,575.00 | |
| Monolithic blocks in place, 1,000 cubic yards, at $8 | | 8,000.00 | |
| | | 9,575.00 | |
| Superintendence, inspection, etc., 10 per cent | $957.50 | | |
| Unforeseen incidentals, accidents, etc., 5 per cent | 478.75 | | |
| | | 1,436.25 | |
| | | | 11,011.25 |
| Total for pierhead | | | 35,622.92 |
| Total for 1,200 feet of completed breakwater on location A-B | | | 271,033.92 |

## *Estimate for location A-C.*

### FOUNDATION AND CRIB.

| | | | |
|---|---|---|---|
| Piling, 3,250 linear feet, at 15 cents | | $487.50 | |
| Riprap embankment, 2,040 cubic yards, at $1.40 | | 2,856.00 | |
| Pine timber, 72,000 feet B. M., at $28 | | 2,016.00 | |
| Iron fastenings, 5,000 pounds, at 3¼ cents | | 162.50 | |
| Stone ballast, 585 cubic yards, at $1.60 | | 936.00 | |
| | | 6,458.00 | |
| Superintendence, inspection, etc., 10 per cent | | 645.80 | |
| | | | $7,103.80 |

### CONCRETE SUPERSTRUCTURE.

| | | | |
|---|---|---|---|
| Footing blocks in place, 62.5 cubic yards, at $10.50 | | 656.25 | |
| Monolithic blocks in place, 239.3 cubic yards, at $6.50 | | 1,555.45 | |
| Railroad track, ties, etc | | 20.00 | |
| | | 2,231.70 | |
| Superintendence, inspection, etc., 10 per cent | $223.17 | | |
| Unforeseen incidentals, accidents, etc., 5 per cent | 111.58 | | |
| | | 334.75 | |
| | | | 2,566.45 |
| Total for 50 feet completed | | | 9,670.25 |
| Cost per linear foot | | | 193.40 |

### PIERHEAD.

| | | | |
|---|---|---|---|
| Piling, 13,520 linear feet, at 15 cents | | $2,028.00 | |
| Riprap embankment, 5,900 cubic yards, at $1.40 | | 8,260.00 | |
| Pine timber, 202,000 feet B. M., at $28 | | 5,656.00 | |
| Iron fastenings, 14,000 pounds, at 3¼ cents | | 455.00 | |
| Stone ballast, 1,800 cubic yards, at $1.60 | | 2,880.00 | |
| | | 19,279.00 | |
| Superintendence, inspection, etc., 10 per cent | | 1,927.90 | |
| | | | $21,206.90 |

CONCRETE SUPERSTRUCTURE.

| | | | |
|---|---|---|---|
| Footing blocks in place, 140 cubic yards, at $11.25 | | $1,575.00 | |
| Monolithic blocks in place, 1,000 cubic yards, at $8 | | 8,000.00 | |
| | | 9,575.00 | |
| Superintendence, inspection, etc., 10 per cent | $957.50 | | |
| Unforeseen incidentals, accidents, etc., 5 per cent | 478.75 | | |
| | | 1,436.25 | |
| | | | $11,011.25 |
| Total for pierhead | | | 32,218.15 |
| Total for 1,500 feet of completed breakwater on location A–C | | | 302,978.15 |

*Commerce.*—The commerce of Marquette Harbor for season of 1902 was 3,110,709 tons of 2,000 pounds, and that of harbor of refuge, Marquette Bay, Michigan, was 1,762,866 tons.

Vessels receiving and discharging cargoes at the docks in the harbor of refuge, Marquette Bay, seek shelter in Marquette Harbor during heavy storms.

It is believed that there will not be any great increase in the commercial interests of the harbors in the future. The commercial interests, present and prospective, of the two harbors involved would not justify the extensive improvements outlined. By building a pierhead 100 feet in length at end of the present breakwater and dredging out shoal at north end of harbor the protected area would be something over 100 acres. It is believed that this would give ample room as a harbor of refuge for the present and prospective commercial interests of Marquette Harbor and harbor of refuge, Marquette Bay, Michigan, combined, with considerable room to spare to vessels desiring to seek shelter between Whitefish Point and Keweenaw Point. There have been no records kept, of which I am aware, of the number of vessels seeking shelter in Marquette Harbor on way between Whitefish Bay and Keweenaw Bay. It is believed that but few of the modern lake vessels would seek shelter in this harbor, but there are unquestionably a number of the old and smaller ones that would seek shelter here if there were a large harbor of refuge of easy access.

Two vessels laden with ore from Duluth sought shelter in this port on the morning of August 30, 1903, and according to the report of the captain of the United States life-saving station at Marquette, Mich, they would not have weathered the northeast gale very much longer if they had not reached this harbor.

There have been no heavy northeast gales in this locality in the past five months, so I have had no chance to observe the effects of one.

The greatest velocity of the northeast wind recorded at the United States signal station at Marquette on the morning of August 30, 1903, was 18 miles an hour, but it must have been much greater out on the lake.

Respectfully submitted, your obedient servant,

F. L. Dever,
*Assistant Engineer.*

Capt. Charles L. Potter,
*Corps of Engineers.*

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## I I 14.

## PRELIMINARY EXAMINATION OF ONTONAGON HARBOR, MICHIGAN.

[Printed in House Doc. No. 235, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith for transmission to Congress a report dated January 17, 1903, by Capt. D. D. Gaillard, Corps of Engineers, on preliminary examination authorized by the river and harbor act approved June 13, 1902, of Ontonagon Harbor, Michigan, "with a view of ascertaining whether further improvements are necessary and to what extent."

For reasons stated therein, Captain Gaillard is of the opinion that at the present time no further improvements are necessary. The division engineer, Col. O. H. Ernst, Corps of Engineers, concurs in this opinion.

The report has been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and attention is respectfully invited to the Board's report of April 17, 1903, in third indorsement thereon.

A project for the improvement of this harbor, to obtain a depth of 12 feet by means of parallel piers and dredging, has been completed, and the improvement is being maintained under appropriations made for that purpose by Congress. In the opinion of the Board of Engineers the depth contemplated by the existing project is sufficient to meet the demands of the present and reasonably prospective commerce, and I concur in its conclusion that this depth should be maintained, but that at present no further improvement of the locality is necessary or desirable.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## REPORT OF CAPT. D. D. GAILLARD, CORPS OF ENGINEERS.

United States Engineer Office,
*Duluth, Minn, January 17, 1903.*

General: In compliance with Department letters of June 23 and July 3, 1902, I have the honor to submit the following report upon the preliminary examination of "Ontonagon Harbor, with a view of ascertaining whether further improvements are necessary, and to what extent."

Ontonagon Harbor is formed by the mouth of Ontonagon River, which flows out between two piers 2,315 and 2,675 feet in length, respectively.

The nearest harbors are the Portage canals on the east, distant 41 miles, and those formed by the Apostle Islands on the west, distant 60 miles.

The approved project for the harbor is for maintaining a navigable depth of 12 feet of water between the piers and up to the bridge, just inside the entrance. The total cost of the improvement to June 30, 1902, had been $344,807.73. An examination made on June 25, 1902, showed that there was a lump in the channel between the piers with but 10 feet of water over it, but that there was an excess of 12 feet on each side of this lump. The spring floods in the Ontonagon River bring down considerable sediment, which is deposited between the piers and at the entrance, necessitating dredging every few years.

A fire in August, 1896, almost obliterated the town, destroying its commercial industries and wiping out most of the business and residence portions. The town has since been rebuilt, and appears to be enjoying a period of considerable prosperity, but the receipts and shipments by water are much less than they were previous to the fire of 1896. The arrivals and clearances for 1895 aggregate 986, while in 1901 they were but 382. The vessel freight received and shipped for 1901 is given in the following table:

*Freight received and shipped.*

[Tons of 2,000 pounds.]

| Items. | Quantity. | Valuation. |
|---|---|---|
| | *Tons.* | |
| General merchandise | 2,322 | $290,250 |
| Coal | 500 | 2,250 |
| Fish | 161 | 14,490 |
| Copper | 1,203 | 403,005 |
| Farm produce | 98 | 9,800 |
| Logs | 14,658 | 29,315 |
| Total | 18,942 | 749,110 |

The value of the shipments for the calendar year 1901 was about 74 per cent greater than in 1900, owing to the fact that new copper mines were opened up in the vicinity, and about 1,200 tons more copper was shipped in 1901 than in 1900.

It is believed that the receipts and shipments by water will show a steady increase in the future, but they do not at the present time warrant any further improvement other than dredging and minor repairs, both of which have been provided for by an appropriation of $5,000, made in the river and harbor act approved June 13, 1902. This harbor, in its present condition, affords shelter to the smaller class of boats which touch at various south shore points between Keweenaw Peninsula and the head of the lake. The depth of water is not sufficient to render it available to boats of the larger class, and, besides, it is considerably off the course of such boats.

As will be seen from an inspection of the following table, Ontonagon does not possess a marked advantage over existing harbors of refuge for boats passing around Devils Island to or from the head of the lake:

| Place. | Chart course. | (a) | (b) | (c) |
|---|---|---|---|---|
| | | *Miles.* | *Miles.* | *Miles.* |
| Ashland | Portage Canal entrance | 47 | 17 | 15 |
| Do | Eagle Harbor | 47 | 20 | 19 |
| Devils Island | Portage Canal entrance | 48 | 27 | 23 |
| Do | Eagle Harbor | 49 | 33 | 31 |
| Do | Outside course, Keweenaw Point | 50 | 36 | 35 |

[a] Distance to nearest shelter for vessels on the several courses when farthest from shelter and equidistant from the two nearest places of refuge, exclusive of Ontonagon—namely, the Apostle Islands and Portage canals.

[b] Distance from Ontonagon at above-mentioned time when farthest from other shelter.

[c] Gives nearest approach to Ontonagon of the respective courses.

The piers are in fair condition, and when the work contemplated next spring has been completed there will be an entrance channel probably 13 or 14 feet in depth.

In view of what precedes, I am of the opinion that at the present time no further improvements are necessary at Ontonagon Harbor.

Very respectfully,

D. D. Gaillard,
*Captain of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 19, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that no improvements at Ontonagon are necessary further than those provided for by appropriations already made.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 11, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer upon a preliminary examination of "Ontonagon Harbor [Michigan], with a view of ascertaining whether further improvements are necessary, and to what extent," the indorsement of the division engineer thereon, and other data available.

A project for the improvement of this harbor, adopted in 1867, provided for a depth of 12 feet to be secured by means of parallel piers and dredging. The improvement as projected was practically completed in 1889, since which time appropriations have been expended for maintenance. With the exception of one lump on which there is at present 10 feet, the projected depth of 12 feet has been maintained.

The act of June 13, 1902, appropriated $5,000 for dredging and minor repairs. With the expenditure of this sum it is expected to secure a depth of 13 to 14 feet. In the opinion of the Board, this depth is sufficient to meet the demands of present and reasonably prospective commerce.

The Board believes that this depth should be maintained, but that at present no further improvement of Ontonagon Harbor, Michigan, is necessary or desirable.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

## I I 15.

## PRELIMINARY EXAMINATION OF BAY AT THE MOUTH OF SPLIT ROCK RIVER, MINNESOTA.

[Printed in House Doc. No. 170, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 11, 1903.*

SIR: I have the honor to submit herewith a report, dated January 16, 1903, by Capt. D. D. Gaillard, Corps of Engineers, on preliminary examination of bay at the mouth of Split Rock River, Minnesota, with a view to constructing a harbor therein. This examination was made in compliance with a requirement in the river and harbor act approved June 13, 1902, and Captain Gaillard expresses the opinion, concurred in by the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers, that the locality is not worthy of improvement by the General Government at the present time.

The Board of Engineers for Rivers and Harbors has considered this report under the provisions of sections 3 and 14 of the above-mentioned act. The locality has been visited through a committee of the Board, and a public hearing held, at which interested parties were afforded an opportunity to express their views. For reasons stated in its report of July 17, 1903, the Board concludes that it is not advisable for the United States to undertake the construction of a harbor at this point.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### REPORT OF CAPT. D. D. GAILLARD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Duluth, Minn., January 16, 1903.*

GENERAL: In compliance with Department letters of June 23 and July 3, 1902, I have the honor to submit the following report upon the preliminary examination of the "bay at the mouth of Split Rock River, with a view to constructing a harbor therein."

Split Rock is a small settlement on the north shore of Lake Superior, at mouth of Split Rock River, 43 miles from Duluth, 18 miles from Agate Bay, and 64 miles from Grand Marais, Minn. It is the lake terminus of the Split Rock and Northern Railroad, a logging road, and is the place where the log rafts of the Split Rock Lumber Company are made up. There is a wharf 184 feet long, 16 feet wide, of timber, resting on cribs filled with rock, extending from the shore out to a depth of 14 feet at low water, so that the north shore coasting steamers can land there, as well as some of the lake freighters. The harbor is a natural indentation, affording complete shelter from westerly to northerly storms, some shelter from northeast storms (the latter being the most dangerous at the westerly end of the lake), and less shelter [illegible] southwest storms. There are no severe storms from the south

Rock Lumber Company owns and controls the harbor and adjoining site, the railroad, coal dock, and store. In fact, all the interests of this locality seem at present to be controlled by this company. The railroad is a logging road, with 10 miles of main track, 3 locomotives, 70 logging cars, a roundhouse with 3 stalls, etc., and is incorporated.

The company has constructed a dam near the mouth of the river, which raises the water 14 feet when filled, and forms a large pond, into which saw logs are dumped from the cars and stored until made up into bag rafts in the lake, to be towed to the sawmill at Duluth. In favorable weather logs are dumped from the cars directly into the lake from a trestle which skirts the shore.

The annual shipments of logs in rafts are about 50,000,000 feet. Four hundred men are employed, of whom about 50 are engaged at the lake terminus and the remainder back on the line in the woods. Five of the employees have their families with them. There is a store and post-office, 40 by 60 feet, semiweekly mail service, a warehouse 40 by 100 feet, two buildings for sleeping and dining quarters, an ice house, 7 dwellings, and a coal dock with 1,000 tons capacity. There are no farms in the immediate vicinity.

The supply of lumber owned by the Split Rock Lumber Company will probably be exhausted in three or four years, but one of the officers of the company stated that negotiations are now in progress for the acquirement of adjoining timber, which, if successful, would prolong lumbering operations three or four years more. The estimated value of the logs shipped from Split Rock Bay is about $600,000 per annum. These logs have been shipped during the past two seasons with comparatively small loss from storms.

It appears from what precedes that all operations at the locality in question are controlled by a single lumber company; and that the character of the industry indicates no permanent commercial importance for the locality, it being probable that the present extensive lumbering operations will not last beyond a period of from three to eight years—depending upon the acquisition of additional timber by the company.

To afford adequate protection to the bay would cost not less than $200,000, and might cost much more, no maps now being available for accurate computations. Experience at Agate Bay and Grand Marais, Minn. (the two adjacent harbors under improvement by the United States), shows that works of about the same magnitude have required fourteen and twenty-one years, respectively, for completion under the intermittent system of appropriations heretofore made. It therefore seems almost certain that the timber in the vicinity would be exhausted before adequate protection to the harbor could be obtained.

For the reasons stated I do not consider the bay at the mouth of Split Rock River worthy of improvement at the present time, although there is a possibility that it may in future be needed as an outlet for some of the vast quantities of iron ore which lie to the north of it.

Respectfully submitted.

D. D. GAILLARD,
*Captain of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 17, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that the bay at the mouth of Split Rock River is not worthy of improvement by the General Government.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 11, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer upon a preliminary examination of "bay at the mouth of Split Rock River, with a view to constructing a harbor therein," the indorsement of the division engineer thereon, and all other data available. On June 29, 1903, a committee of the Board held a public hearing with reference to this subject at Duluth, Minn., at which interested parties were given opportunity to express their views, and on the following day the committee made an inspection of the locality.

Spilt Rock River flows into Lake Superior at a point 43 miles northeast of Duluth, 18 miles northeast of Agate Bay (Two Harbors), and 64 miles southwest of Grand Marais. The river mouth has been dammed to afford storage for logs, and here is the terminus of a small logging railroad and a settlement or camp of about 50 employees of the Split Rock Lumber Company which owns all the surrounding lands.

At this point there is a slight natural indentation of the shore line, forming a small and inferior natural harbor, protected from westerly and northerly winds, but exposed to winds from other directions.

At Split Rock Harbor there are now made into rafts to be towed to Duluth about 50,000,000 feet of logs annually. There are no other shipments from this point and no receipts except supplies for the 400 or 500 employees of the lumber company.

It is reported that the timber now owned by the Split Rock Lumber Company will be exhausted in three or four years, but that negotiations are now in progress looking to an increase of its holdings.

There is no railroad connecting Split Rock with the ore deposits, some 50 to 60 miles inland. Rail routes already connect the ore lands with Duluth and Two Harbors. The Board has been unable to discover that any ore road to Split Rock is now in contemplation.

If additional ore docks or harbors for general commercial use are required between Two Harbors and Grand Marais, conditions are not yet sufficiently developed and fixed to enable the proper locality to be selected. The interior back from this part of the shore is sparsely settled, and there are practically no facilities for communication.

There have been many representations made to the Board that a harbor of refuge at Split Rock would be of great benefit to the shipping of Lake Superior. The great lake carriers in the Duluth and Superior trade habitually pass from 18 to 20 miles south of Split Rock, and when nearest that point are equally near to the Apostle Islands, which lie close by their course and afford perfect shelter in storms. Due to the unsettled state of the country, and the limited facilities for transportation to the interior from north shore points, there is a very small commerce between Duluth and Grand Marais, or Canadian points farther northward. It appears to the Board that the commerce last mentioned is all that would be benefited materially by a harbor of refuge at Split Rock. Due to the great depths existing close inshore a harbor of refuge of sufficient capacity to shelter the longer class of lake vessels in severe storms would be enormously expensive. Neither such a large harbor nor a small harbor for general commerce, and for the shelter of the smaller classes of vessels plying along the north shore, would present advantages at all commensurate with the cost.

The Board is of opinion that it is not advisable for the United States to undertake the construction of a harbor at Split Rock, Minn.

For the Board:

Chas. J. Allen,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## I I 16.

## PRELIMINARY EXAMINATION OF ST. LOUIS RIVER, FROM THE FOOT OF THE RAPIDS TO NEW DULUTH, MINNESOTA.

[Printed in House Doc. No. 215, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a report, dated January 16, 1903, by Capt. D. D. Gaillard, Corps of Engineers, on preliminary examination of St. Louis River from the foot of the rapids to New Duluth, Minn., with a view to increasing the depth to 8 feet, made in pursuance of a requirement of the river and harbor act approved June 13, 1902. In the opinion of Captain Gaillard, concurred in by the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers, the locality is worthy of improvement, with a view to increasing the depth to 8 feet.

This report has been reviewed by the Board of Engineers for Rivers and Harbors in accordance with the provisions of sections 3 and 14 of the above-mentioned act, available data have been duly considered, and a public hearing has been held, at which interested parties were given an opportunity to express their views. For the reasons stated in its report of July 11, 1903, the Board concludes that it is not desirable for the United States to undertake this improvement, and I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF CAPT. D. D. GAILLARD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Duluth, Minn., January 16, 1903.*

GENERAL: In compliance with Department letters of June 23 and July 3, 1902, I have the honor to submit the following report upon the preliminary examination of the "St. Louis River from the foot of the rapids to New Duluth, with a view to increasing the depth to 8 feet."

*Description of locality.*—The lower end of this stretch, at New Duluth, is 15 miles from the Duluth Ship Canal via the improved channel of the St. Louis River. The 20-foot navigable depth extends from the Duluth Ship Canal to within 5 miles of New Duluth, from which point to New Duluth the river has a navigable depth of 12 feet for a width of 100 feet.

From New Duluth to Fond du Lac the distance by the main channel is about 3⅝ miles, and the available depth only about 7 feet, due to three short bars. By the cut-off channel the distance is about 3 miles, with an available depth of 6 feet through the cut-off, and of 7 feet over two other short bars. Between the bars the depth ranges from 10 to 23 feet. From Fond du Lac to the foot of the rapids the distance is about 1¼ miles and the available depth about 4 feet for a very narrow width on the Minnesota side.

The portion of the river from about three-fourths of a mile below the foot of the rapids to New Duluth runs through flats, has a considerable cross section, and for the ordinary flow of the river, which is about 500 cubic feet per second, is practically a level pool, where appreciable currents may be produced, either up or down stream, by sudden fluctuations in the level of Lake Superior.

From the foot of the rapids to a point about three-fourths of a mile below the same the river is confined to one narrow channel, with numerous bowlders on the bottom, and is bordered by a high bluff on the Minnesota side. With extreme low water the level of this stretch is practically the same as that below, but with a small rise in the river
is a strong current setting downstream.
usually only slightly sedimentary. It is subject to
occur about once in every four or five years
periods of moderately high water inter-

vening. The floods bring down a small quantity of material and drop it below the foot of the rapids, depositing bowlders, shingle, gravel, sand, and silt, in the order named, deepening the channel on bends and forming bars on the crossings between.

*Present and prospective commerce.*—Four brownstone quarries have been opened up on the river between Fond du Lac and the foot of the rapids. Shipments have been made by the river from three of these quarries, but none have been made from the fourth one, which is practically at the foot of the rapids.

Mr. J. H. Crowley, president of the Duluth Brown Stone Company, which owns two of the quarries, only one of which is worked at present, states that the gross receipts of his company for the fifteen years, 1887 to 1901, were $167,198.43, which would represent the shipment of approximately 167,000 tons of brownstone by river, and that the shipments for the season of 1902 were approximately 14,500 tons. Mr. Crowley states that on the 53 acres on the Wisconsin side of the river owned by his company it is estimated that there are about 7,000,000 cubic yards of stone above the water surface, and that the quarries can be worked considerably below the water surface.

The Chambers quarry, on the Minnesota side of the river, was worked from 1887 to 1892, and shipped about the same amount of stone in that time as did the Duluth Brown Stone Company. Work at this quarry was discontinued as a result of stagnation in building operations about 1892; later, the owner, Mr. M. E. Chambers, died, and the quarry has not been worked since.

The St. Louis River Water Power Company opened up a quarry in 1891, near the foot of the rapids on the Minnesota side, but no shipments were ever made from this quarry.

Large quantities of brownstone are in sight on the Minnesota side of the river, but no estimate of the total amount is available.

Mr. S. C. Jackson, vice-president of the Clark-Jackson Lumber Company, states that his company has brought down 100,000,000 feet of logs from above the rapids during the past seven years, and has some pine and considerable cedar yet to come out.

A large amount of cedar has been brought down the river during the past few years for ties and posts, but no estimate of the amount is available.

There are large quantities of pine, cedar, and other timber tributary to the St. Louis River, a portion of which will probably seek an outlet via this channel.

During the season of 1902 one boat was engaged in the excursion business between Duluth and West Superior and Fond du Lac, making daily trips.

Fond du Lac lies within the corporate limits of the city of Duluth, and has a population of about 250.

The Duluth Brown Stone Company some time previous to the year 1891 dredged a channel through the shoals on the Wisconsin side of the upper stretch of the navigable portion, covering a distance of about 1 mile, for the purpose of reaching the quarries of that company with tugs and scows. The cost of this work is stated to have been about $7,500.

Mr. M. E. Chambers, the owner of a brownstone quarry in the village of Fond du Lac, dredged a channel about 500 feet long through a bar in the river on the Minnesota side, about the year 1888, for the purpose of giving access to his quarry for tugs and scows. The cost of this improvement is stated to have been about $1,000.

The channels have since become partly filled up by flood deposits, so that it is now impossible for tugs to reach the quarries.

The commerce of this portion of the river, consisting mostly of the shipment of brownstone to the cities of Duluth and Superior, of logs to the mills, of cedar posts and ties to various points in the harbor, and of the excursion business, is almost entirely local. If the channel between the foot of the rapids and New Duluth were improved the shipment of brownstone from the aforementioned quarries would undoubtedly be greatly increased, incident to the rapid growth of the cities of Duluth and Superior and their great commercial importance.

In view of what precedes, it is my opinion that St. Louis River from the foot of the rapids to New Duluth is worthy of improvement with the view of increasing the depth to 8 feet, and I would respectfully recommend that a survey of the area in question be made for the preparation of a report, with plans and estimate of cost of the improvement. The cost of the survey, plans, and estimate would be about $600.

Respectfully submitted.

D. D. GAILLARD,
*Captain of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 17, 1903.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 11, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer upon a preliminary examination of "St. Louis River from the foot of the rapids to New Duluth, with a view to increasing the depth to 8 feet," the indorsement of the division engineer thereon, and all other data available. On June 29, 1903, a committee of the Board inspected the locality, and held a public hearing at Duluth, Minn., at which interested parties were given opportunity to express their views.

The St. Louis River, forming the harbor of Duluth, Minn., has been improved to a depth of 20 feet for a distance of 10 miles from the Duluth Ship Canal. Thence, ascending the stream, there exists a 12-foot channel to New Duluth, 15 miles from the ship canal. From New Duluth to Fond du Lac, 3⅝ miles, the available depth is 7 feet, and from Fond du Lac to a point nearly a mile above, where are located several brownstone quarries, there is an available depth of 4 feet in a narrow channel.

There is very little commerce above New Duluth. About 14,500 tons of brownstone valued at $1 per ton, represent the water shipments for 1902, and an excursion business is done between Duluth and Fond du Lac.

Fond du Lac is a small village without important commercial industries. It is anticipated locally that the development of water power at the rapids above this village, in accordance with projects already formed, will induce the location of a number of factories.

There is no commerce in immediate view, except from the quarries above mentioned. The channel already existing enables this stone, which is not of superior quality, to reach a market, and it is not apparent that any improvement of the river would bring benefits, even to the quarry owners, that would be commensurate with the cost to the United States.

For the reasons stated above the Board believes that it is not advisable for the United States to undertake the improvement of "St. Louis River from the foot of the rapids to New Duluth, with a view to increasing the depth to 8 feet."

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

# APPENDIX J J.

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## IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN SHORE OF LAKE MICHIGAN.

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### *REPORT OF MAJ. J. G. WARREN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

#### IMPROVEMENTS.

1. Menominee Harbor and River, Michigan and Wisconsin.
2. Oconto Harbor, Wisconsin.
3. Greenbay Harbor, Wisconsin.
4. Sturgeon Bay and Lake Michigan Ship Canal, and harbor of refuge connected therewith, Wisconsin.
5. Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.
6. Ahnapee (Algoma) Harbor, Wisconsin.
7. Kewaunee Harbor, Wisconsin.
8. Two Rivers Harbor, Wisconsin.
9. Manitowoc Harbor, Wisconsin.
10. Sheboygan Harbor, Wisconsin.
11. Port Washington Harbor, Wisconsin.
12. Harbor at Milwaukee, Wisconsin, including harbor of refuge.
13. South Milwaukee Harbor, Wisconsin.
14. Racine Harbor, Wisconsin.
15. Kenosha Harbor, Wisconsin.
16. Waukegan Harbor, Illinois.
17. Fox River, Wisconsin.
18. Operating and care of locks and dams on Fox River, Wisconsin.

#### EXAMINATIONS AND SURVEYS.

19. Gladstone Harbor, Michigan.
20. Manistique Harbor, Michigan.
21. Menominee, Milwaukee, and Kinnickinnick rivers, Milwaukee Harbor, Wisconsin.
22. Port Washington Harbor, Wisconsin.
23. South Milwaukee Harbor, Wisconsin.
24. Stone Haven Harbor, Wisconsin.

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United States Engineer Office,
*Milwaukee, Wis., July 15, 1904.*

General: I have the honor to transmit herewith annual report for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

J. G. Warren,
*Major, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## J J 1.

## IMPROVEMENT OF MENOMINEE HARBOR AND RIVER, MICHIGAN AND WISCONSIN.

The natural condition of this work and its projects for its improvement are described and references for more extended information are given in Annual Report of Chief of Engineers for 1903, page 475.

For reports on examinations and surveys, see House Documents No. 86, Fifty-fourth Congress, second session, and No. 419, Fifty-sixth Congress, first session, and Annual Reports for 1897, page 2751, and for 1900, pages 3739-3745.

*Operations during the fiscal year.*—Dredging was continued under a contract with the Duluth Dredge and Dock Company until July 23, 1903, and the contract then closed. During the fiscal year 8,239 cubic yards of sand, etc., and 14,933 cubic yards of hardpan and bowlders were removed—a total of 23,172 cubic yards of material. The total number of cubic yards of material removed under this contract was 157,334.

The contract prices were $12\frac{9}{10}$ cents per cubic yard for sand, etc., and 48 cents per cubic yard for hardpan and bowlders.

United States dredge *No. 1*, during May and June, 1904, removed 20,481 cubic yards of material from the lower end of the channel, at a cost of $11\frac{9}{10}$ cents per cubic yard.

*Condition of the improvement.*—The piers are built the full length contemplated and are in fair condition, with the exception of 1,050 linear feet that requires renewal above the water line.

The condition of the channel is described in the current summary, page 519.

*Proposed operations.*—It is proposed to apply the funds available in rebuilding above the water line 1,050 linear feet of the harbor piers and in making such minor repairs as may be necessary, and to apply the additional appropriation of $68,000 recommended in completing the 20-foot channel up to the basin and enlargement of the basin by dredging and rock removal.

*Remarks and recommendations.*—The present project provides for a channel 60 to 75 feet wide above the turning basin for a distance of 425 feet. To deepen this channel to the projected depth of 20 feet will involve the removal of about 8,000 cubic yards of solid rock, at an estimated cost of $16,000. This channel is at the extreme westerly end of the improvement and its improvement is a matter of local interest only, as it is more in the nature of a slip than a public waterway. For these reasons it is recommended that the project be modified to omit the improvement of this channel. In this connection attention is invited to the Annual Report for 1903, page 476.

While deepening the channel to 20 feet the fact was disclosed that the quantity of hardpan, bowlders, and rock to be removed under the present project is far greater than there was reason to suppose when the original estimate was submitted.

In the original estimate it was not expected that solid rock would be encountered elsewhere than in the narrow channel extending 425 feet above the turning basin. Dredging has disclosed the fact not only is the amount of hardpan and bowlders much greater than was anticipated, but that solid rock is found in the basin and in the channel immediately below same, at a depth less than 20 feet. Much of the material heretofore classified as sand is found to be a quicksand that is as difficult and expensive to dredge as hardpan.

A revised estimate of the cost of completing the present project, exclusive of the channel extending 425 feet above the turning basin as above described, is submitted herewith.[a]

*Estimate.*

| | |
|---|---|
| 34,500 cubic yards sand, clay, etc., at 12.9 cents | $4,450.50 |
| 71,600 cubic yards hardpan, bowlders, and quicksand, at 48 cents | 34,368.00 |
| 11,500 cubic yards of solid rock, at $2 | 23,000.00 |
| Contingencies, superintendence, etc | 6,181.50 |
| Total | 68,000.00 |

The total revised estimate of cost of present project, omitting the channel above turning basin, is as follows:

| | |
|---|---|
| Amount expended on present project | $38,251.69 |
| Estimated cost of completion | 68,000.00 |
| Total | 106,251.69 |

It is believed that the funds available are sufficient for maintenance of existing works to June 30, 1906.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $38,493.64 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $24,415.22 | |
| For maintenance of improvement | 1,722.10 | |
| | | 26,137.32 |
| July 1, 1904, balance unexpended | | 12,356.32 |
| Amount (estimated) required for completion of existing project | | 68,000.00 |

APPROPRIATIONS.

*Harbor.*

| Act of— | | |
|---|---|---|
| March 3, 1871 | $25,000.00 | |
| June 10, 1872 | 25,000.00 | |
| March 3, 1873 | 25,000.00 | |
| June 23, 1874 | 25,000.00 | |
| March 3, 1875 | 25,000.00 | |
| August 14, 1876 | 8,000.00 | |
| June 18, 1878 | 10,000.00 | |
| March 3, 1879 | 10,000.00 | |
| June 14, 1880 | 10,000.00 | |
| March 3, 1881 | 12,000.00 | |
| August 3, 1882 | 15,000.00 | |
| July 5, 1884 | 10,000.00 | |
| August 5, 1886 | 3,000.00 | |
| August 11, 1888 | 9,000.00 | |
| August 18, 1894 | 10,000.00 | |
| June 3, 1896 | 7,150.00 | |
| March 3, 1899 | 5,500.00 | |
| | | $234,650.00 |

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[a] See my report to Chief of Engineers, dated June 28, 1904, and second indorsement thereto, dated July 5, 1904.

*River.*

| | | |
|---|---|---|
| Act of— | | |
| September 19, 1890 | $54,000.00 | |
| July 13, 1892 | 20,500.00 | |
| August 18, 1894 | 6,000.00 | |
| June 3, 1896 | 15,000.00 | |
| March 3, 1899 | 18,920.00 | |
| | | $114,420.00 |
| *Harbor and river.* | | |
| Act of June 13, 1902 | | 50,350.00 |
| Miscellaneous receipts credited to appropriations | | 1,669.03 |
| Total | | 401,089.03 |

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. C. I. Cook, Menominee, Mich., and Mr. J. W. Laughrey, deputy collector of customs, Marinette, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 538 | 538 |
| Sail | 426 | 424 |
| Total | 964 | 962 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 751,819 |
| Imports | 629,935 |
| Total | 1,381,754 |
| Tonnage in calendar year ending December 31, 1902 | 1,155,569 |
| Increase in 1903 | 226,185 |

*Principal articles of export.*—Lumber, lime and cement, coal and coke, telegraph poles, and general merchandise.

*Principal articles of import.*—Fence posts, coal and coke, iron and steel, saw logs, and general merchandise.

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## J J 2.

## IMPROVEMENT OF OCONTO HARBOR, WISCONSIN.

The natural condition of this harbor and projects for its improvement are described, and references for more extended information and maps given, in Annual Report for 1903, pages 476 and 1835–1839.

For reports on examinations and surveys, see House Documents No. 223, Fifty-fourth Congress, first session, and No. 50, Fifty-sixth Congress, first session; Annual Reports for 1896, page 2560, and 1900, page 3745.

*Operations during the fiscal year.*—There were no operations.

*Condition of the improvement.*—No material change in the condition of this improvement has occurred since June 30, 1902. (See Annual Report for 1902, p. 2046.)

*Proposed operations.*—It is proposed to apply the funds available in maintenance of the south pier.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $3,650.23 |
| July 1, 1904, balance unexpended | 3,650.23 |
| Amount (estimated) required for completion of existing project | 22,610.00 |

---

APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| March 3, 1881 | $10,000 | August 18, 1894 | $3,000 |
| August 2, 1882 | 15,000 | June 3, 1896 | 4,000 |
| July 5, 1884 | 15,000 | March 3, 1899 | 15,000 |
| August 5, 1886 | 8,000 | June 13, 1902 | 3,000 |
| August 11, 1888 | 20,000 | | |
| July 13, 1892 | 3,000 | Total | 96,000 |

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. W. A. Holt, mayor of Oconto, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 155 | 155 |
| Sail | 62 | 62 |
| Total | 217 | 217 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 11,719 |
| Imports | 31,284 |
| Total | 43,003 |
| Tonnage in calendar year ending December 31, 1902 | 50,433 |
| Decrease in 1903 | 7,430 |

*Principal articles of export.*—Lumber, wood, hay, and general merchandise.

*Principal articles of import.*—Coal and coke, stone, hay, land plaster, and general merchandise.

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## J J 3.

## IMPROVEMENT OF GREEN BAY HARBOR, WISCONSIN.

The natural condition of this work and projects for its improvement are described, and reference for more extended information are given in Annual Report of the Chief of Engineers for 1903, pages 477, 478.

For reports on examinations and surveys see House Documents No. 22, Fifty-second Congress, second session, and No. 232, Fifty-sixth Congress, first session. Also Annual Reports for 1893, page 2778, and for 1900, pages 3747-3752.

*Operations during the fiscal year.*—Dredging was continued under a contract with Mr. Samuel O. Dixon and was completed November 14, 1903; 671,201 cubic yards of material were removed during the fiscal year. Contract price 12 cents per cubic yard; cost, exclusive of inspection and supervision, $80,544.12. The total number of cubic yards removed under this contract was 819,175.

In January, 1904, soundings were taken through the ice from Depere to the 21-foot contour in Green Bay, a distance of about 10¾ miles, and subsequently maps prepared.

*Condition of the improvement.*—The east revetment at Grassy Island, 705 feet long, is in good condition, the west revetment, 620 feet long, requires renewal above the water line.

With an unimportant exception dredging was carried over the entire area of the outer channel, but the soundings disclosed numerous shoal places where the full depth of 20 feet had not been secured. For details attention is invited to a special report dated March 8, 1904.

*Proposed operations.*—It is proposed to apply the funds available, first, in dredging to remove the most troublesome shoals in the outer channel; second, any balance that may be remaining, together with the additional appropriation recommended, in the renewal of the west revetment and dredging for maintenance of the channels.

*Remarks and recommendations.*—The recommendation contained in report dated March 8, 1904, for an allotment of $5,000 to do necessary dredging was approved April 8, 1904, and the work was begun July 1, 1904.

An appropriation of $15,000 for the maintenance of existing works for the fiscal year ending June 30, 1906, is recommended.

*Estimate.*

| | |
|---|---|
| For rebuilding west revetment, 620 linear feet, at $10 | $6,200 |
| For dredging 50,000 cubic yards, at 15 cents | 7,500 |
| Contingencies | 1,300 |
| Total | 15,000 |

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $92,555.64 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | 5,000.00 |
| | 97,555.64 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 91,846.93 |
| July 1, 1904, balance unexpended | 5,708.71 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 15,000.00 |

APPROPRIATIONS.

| Act of— | |
|---|---|
| June 23, 1866 | $30,500.00 |
| March 2, 1867 | 45,000.00 |
| July 25, 1868 (allotted) | 17,500.00 |
| April 10, 1869 (allotted) | 44,550.00 |
| July 11, 1870 | 17,500.00 |
| March 3, 1871 | 17,500.00 |
| March 3, 1873 | 20,000.00 |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 10,000.00 |
| August 14, 1876 | 8,000.00 |
| June 18, 1878 | 5,000.00 |
| March 3, 1879 | 4,000.00 |
| June 14, 1880 | 6,000.00 |
| March 3, 1881 | 5,000.00 |
| August 2, 1882 | 20,000.00 |
| July 5, 1884 | 10,000.00 |
| August 5, 1886 | $7,000.00 |
| August 11, 1888 | 10,000.00 |
| September 19, 1890 | 10,000.00 |
| July 13, 1892 | 25,000.00 |
| August 18, 1894 | 25,000.00 |
| June 3, 1896 | 25,000.00 |
| July 19, 1897 | 5,000.00 |
| March 3, 1899 | 28,600.00 |
| June 13, 1902 | 105,600.00 |
| June 13, 1902 (allotment from emergencies, river and harbor) | 5,000.00 |
| Miscellaneous receipts credited to appropriations | 52.50 |
| Total | 516,802.50 |

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COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. M. J. McCormick, Green Bay, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam and sail | 1,397 | 1,401 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 584,982 |
| Imports | 802,824 |
| Total | 1,387,806 |
| Tonnage in calendar year ending December 31, 1902 | 1,135,498 |
| Increase in 1903 | 252,308 |

*Principal articles of export.*—Grain, brick, coal and coke, flour, fish, and general merchandise.

*Principal articles of import.*—Coal and coke, lumber, wood, salt, and general merchandise.

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## J J 4.

## IMPROVEMENT OF STURGEON BAY AND LAKE MICHIGAN SHIP CANAL AND HARBOR OF REFUGE CONNECTED THEREWITH, WISCONSIN.

The natural condition of this work and projects for its improvement are described and references for more extended information and maps are given in Annual Report of the Chief of Engineers for 1903, pages 478 and 1841.

For report on examination and survey, see House Document No. 117, Fifty-sixth Congress, second session, and Annual Report for 1901, page 2970.

*Operations during the fiscal year.*—Under the continuing contract for dredging and rock removal, work has been in progress during the fiscal year, during which time 1,469,061 cubic yards of sand, etc., has been dredged and 3,436.67 cubic yards of rock removed from the canal, harbor, and connecting channel. The contract price for dredging sand, etc., is 9.9 cents per cubic yard, at a cost of $145,437.04. The contract price for rock removal is $5.50 per cubic yard and the cost for same is $18,901.69.

The results accomplished by these expenditures are stated in current summary. (See Annual Report, 1904, p. 522.)

*Condition of the improvement.*—The harbor piers are built the full length projected. About 1,100 feet of the inshore portions of the piers, and the detached portion of the north pier, 150 feet in length, require rebuilding above the water surface.

The canal revetments are completed and are in good condition.

*Proposed operations.*—It is proposed to apply available balances in dredging under the existing contract and in the renewal of about 1,250 feet of the harbor piers above the water line; also in doing the dredging required in the vicinity of the bridge as soon as practicable.

*Remarks.*—It is believed that the funds available are sufficient to complete the work outlined; therefore no additional estimate is submitted.

For detailed information concerning the conditions existing at and in the immediate vicinity of the bridge across Sturgeon Bay attention is respectfully invited to my report dated December 9, 1903, made in compliance with instructions contained in second indorsement on E. D. file 32378–54; also my report dated April 13, 1904, E. D. 32378–64, relating to the same.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $221,454.84 |
| Miscellaneous receipts | 193.01 |
| | 221,647.85 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 146,007.78 |
| July 1, 1904, balance unexpended | 75,640.07 |
| July 1, 1904, amount covered by uncompleted contracts | 43,852.09 |

APPROPRIATIONS.

*Harbor of refuge.*

| Act of— | | |
|---|---|---|
| March 3, 1873 | $40,000.00 | |
| March 23, 1874 | 10,000.00 | |
| June 18, 1878 | 30,000.00 | |
| March 3, 1879 | 30,000.00 | |
| June 14, 1880 | 10,000.00 | |
| March 3, 1881 | 10,000.00 | |
| August 2, 1882 | 20,000.00 | |
| July 5, 1884 | 10,000.00 | |
| August 5, 1886 | 5,000.00 | |
| September 19, 1890 | 3,000.00 | |
| July 13, 1892 | 5,000.00 | |
| August 18, 1894 | 5,000.00 | |
| June 3, 1896 | 5,000.00 | |
| March 3, 1899 | 5,500.00 | |
| | | $188,500.00 |

*Canal.*

| | | |
|---|---|---|
| Act of— | | |
| July 13, 1892 | $81,833.00 | |
| August 18, 1894 | 20,000.00 | |
| June 3, 1896 | 30,000.00 | |
| March 3, 1899 | 30,000.00 | |
| | | $161,833.00 |

*Canal and harbor of refuge.*

| | | |
|---|---|---|
| Act of— | | |
| June 13, 1902 | $44,000.00 | |
| March 3, 1903 | 178,000.00 | |
| | | 222,000.00 |
| Miscellaneous receipts credited to appropriations | | 12,076.56 |
| Total | | 584,409.56 |

---

### CONTRACT IN FORCE.

For dredging 1,500,000 cubic yards, at 9.9 cents per cubic yard, and for 3,000 cubic yards of rock removal, at $5.50 per cubic yard.

Name of contractor: Duluth Dredge and Dock Company.
Date of contract: March 28, 1903.
Date of approval: April 11, 1903.
Date of commencement: May 25, 1903.
Date for completion: December 31, 1904.

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### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. Adam N. Dier, superintendent Sturgeon Bay and Lake Michigan Ship Canal Wisconsin.]

*Arrivals and departures of vessels.*

| Class. | Bound down. | | Bound up. | | Total. | |
|---|---|---|---|---|---|---|
| | Number. | Net tons. | Number. | Net tons. | Number. | Net tons. |
| 1903. | | | | | | |
| Steam | 838 | 435,450 | 746 | 376,853 | 1,584 | 812,308 |
| Sail | 432 | 63,345 | 379 | 42,697 | 811 | 106,042 |
| Unrigged | 301 | 313,960 | 310 | 314,322 | 611 | 628,282 |
| Total | 1,571 | 812,755 | 1,435 | 733,872 | 3,006 | 1,546,627 |
| 1902 | 1,708 | 868,961 | 1,592 | 771,753 | 3,300 | 1,640,714 |
| 1901 | 1,986 | 922,652 | 1,776 | 764,666 | 3,762 | 1,687,318 |
| 1900 | 1,760 | 749,944 | 1,693 | 684,927 | 3,453 | 1,434,871 |
| 1899 | 2,015 | 785,378 | 1,825 | 631,734 | 3,840 | 1,417,112 |
| 1898 | 1,921 | 669,641 | 1,855 | 616,244 | 3,775 | 1,285,885 |

Navigation through the canal for the season of 1903 was resumed April 2, and was practically closed December 14, a period of 256 days.

| | |
|---|---|
| Average number of craft passing through the canal per day for the whole season (not including tugs) | 11.74 |
| Average net tons passing through canal per day for the whole season (not including tonnage of tugs) | 6,041.51 |
| Average net tonnage of— | |
| Steam craft | 512.81 |
| Sail craft | 130.75 |
| Unrigged craft | 1,028.28 |

*Statement of freight and passengers carried through the canal during the calendar year ending December 31, 1903.*

BOUND DOWN.

| Articles. | Net tons. | Articles. | Net tons. |
|---|---|---|---|
| Agricultural implements | 217 | Logs | 1,053 |
| Brick | 2,000 | Lumber | 450 |
| Coal | 56,647 | Merchandise (general) | 46,056 |
| Fish | 3,932 | Salt | 6,606 |
| Flour | 215 | Wood | 763 |
| Fruit | 1,592 | | |
| Grain (all kinds) | 3,132 | Total | 132,404 |
| Hay | 411 | Passengers ... number | 9,362 |
| Iron (manufactured) | 9,330 | | |

BOUND UP.

| Article. | Net tons. | Article. | Net tons. |
|---|---|---|---|
| Bark | 99 | Paper | 830 |
| Coal | 11,636 | Poles (telegraph) | 12,580 |
| Dairy products | 142 | Posts (fence and paving) | 3,448 |
| Fish | 1,259 | Potatoes | 34 |
| Flour | 1,273 | Salt | 456 |
| Grain (all kinds) | 3,890 | Stone (building and crib) | 97,915 |
| Hay | 166 | Ties (railroad) | 11,690 |
| Hides | 450 | Tile (building) | 1,650 |
| Iron (manufactured) | 2,070 | Trees (Christmas) | 660 |
| Iron (pig) | 150 | Wood | 22,183 |
| Logs | 645 | | |
| Lumber | 277,988 | Total | 472,394 |
| Merchandise (general) | 21,150 | Passengers ... number | 9,265 |

Total number of net tons of freight carried through the canal during the calendar year ending December 31, 1903 ........ 604,798

Total number of passengers carried through the canal during the calendar year ending December 31, 1903 ........ 18,627

*Statement showing quantity and estimated value of freight carried through the canal during the calendar year ending December 31, 1903.*

| Item. | Quantity. | Price per unit. | Total valuation. |
|---|---|---|---|
| Agricultural implements ... tons.. | 217 | $200.00 | $43,400.00 |
| Bark ... cords.. | 90 | 7.50 | 675.00 |
| Brick ... M.. | 1,000 | 8.00 | 8,000.00 |
| Coal ... tons.. | 68,283 | 4.50 | 307,273.50 |
| Dairy products ... do.... | 142 | 250.00 | 35,500.00 |
| Fish ... do.... | 1,259 | 100.00 | 125,900.00 |
| Flour ... barrels.. | 13,850 | 5.50 | 76,175.00 |
| Fruit ... tons.. | 1,592 | 60.00 | 95,520.00 |
| Grain: | | | |
| Barley ... bushels.. | 68,000 | .45 | 30,600.00 |
| Corn ... do.... | 45,620 | .60 | 27,372.00 |
| Oats ... do.... | 132,000 | .40 | 52,800.00 |
| Pease ... do.... | 69,144 | 1.25 | 86,430.00 |
| Hay ... tons.. | 577 | 10.00 | 5,770.00 |
| Hides ... do.... | 450 | 130.00 | 58,500.00 |
| Iron: | | | |
| Manufactured ... do.... | 11,400 | 75.00 | 855,000.00 |
| Pig ... do.... | 150 | 30.00 | 4,500.00 |
| Logs ... M feet B. M.. | 1,601 | 15.00 | 24,015.00 |
| Lumber ... do.... | 185,625 | 25.00 | 4,640,625.00 |
| Merchandise (general) ... tons.. | 67,206 | 175.00 | 11,761,050.00 |
| Paper ... do.... | 830 | 60.00 | 49,800.00 |
| Poles (telegraph) ... number.. | 74,326 | 4.00 | 297,304.00 |
| Posts (fence and paving) ... do.... | 181,490 | .20 | 36,298.00 |
| Potatoes ... barrels.. | 500 | 1.50 | 750.00 |
| Salt ... do.... | 50,616 | 1.10 | 55,677.60 |
| Stone (building and crib) ... tons.. | 97,915 | .95 | 93,019.25 |
| Ties (railroad) ... number.. | 167,000 | .30 | 50,100.00 |
| Tile (building) ... tons.. | 1,650 | 25.00 | 41,250.00 |
| Trees (Christmas) ... number.. | 30,000 | .60 | 18,000.00 |
| Wood ... cords.. | 9,178 | 6.00 | 55,068.00 |
| Total | | | 18,936,372.35 |

*Comparative statement of principal items of commerce through the canal for the calendar years 1902 and 1903.*

| Item. | Year. |  | Increase. | Decrease. |
|---|---|---|---|---|
|  | 1902. | 1903. |  |  |
| Vessels..........number.. | 3,300 | 3,006 | .......... | 294 |
| Tonnage..........tons.. | 1,640,714 | 1,546,627 | .......... | 94,087 |
| Tonnage (cargo)..........do.... | 638,835 | 604,798 | .......... | 34,037 |
| Passengers..........number.. | 15,861 | 18,627 | 2,766 | .......... |
| Agricultural implements..........tons.. | 565 | 217 | .......... | 348 |
| Coal..........do.... | 23,084 | 68,283 | 45,199 | .......... |
| Fish..........do.... | 3,001 | 1,259 | .......... | 1,742 |
| Flour..........barrels.. | 7,500 | 13,850 | 6,350 | .......... |
| Fruit..........tons.. | 563 | 1,592 | 1,029 | .......... |
| Grain (all kinds)..........bushels.. | 149,100 | 314,764 | 165,664 | .......... |
| Hay..........tons.. | 185 | 577 | 392 | .......... |
| Iron: |  |  |  |  |
| Manufactured..........do.... | 6,190 | 11,400 | 5,210 | .......... |
| Pig..........do.... | 540 | 150 | .......... | 390 |
| Lumber..........M feet B. M.. | 250,967 | 185,625 | .......... | 65,342 |
| Merchandise (general)..........tons.. | 83,006 | 67,206 | .......... | 15,800 |
| Paper..........do.... | 400 | 830 | 430 | .......... |
| Poles (telegraph)..........number.. | 92,800 | 74,326 | .......... | 18,474 |
| Posts (fence and paving)..........do.... | 194,200 | 181,490 | .......... | 12,710 |
| Potatoes..........barrels.. | 9,917 | 500 | .......... | 9,417 |
| Salt..........do.... | 28,441 | 50,616 | 22,175 | .......... |
| Stone (building and crib)..........tons.. | 72,885 | 97,915 | 25 030 | .......... |
| Ties (railroad)..........number.. | 225,600 | 167,000 | .......... | 58,600 |
| Wood..........cords.. | 5,948 | 9,178 | 3,230 | .......... |

| | |
|---|---|
| Estimated value of freight passing through the canal during the calendar year ending December 31, 1903.......... | $18,936,372.35 |
| Estimated value of freight passing through the canal during the calendar year ending December 31, 1902.......... | 21,947,885.85 |
| Decrease in value of freight in 1903 as compared with 1902... | 3,011,513.50 |

*Statement showing number and net tonnage of tugs passing through the canal during the calendar year ending December 31, 1903, and the number of vessels and unrigged craft towed during that time.*

BOUND DOWN.

| Month. | Number. | Net tons. | Vessels towed. | Unrigged towed. |
|---|---|---|---|---|
| March.......... | 23 | 465 | .......... | .......... |
| April.......... | 28 | 695 | 4 | 2 |
| May.......... | 43 | 1,203 | 7 | 12 |
| June.......... | 81 | 2,108 | 24 | 10 |
| July.......... | 74 | 1,889 | 16 | 28 |
| August.......... | 52 | 1,513 | 6 | 21 |
| September.......... | 64 | 1,869 | 12 | 31 |
| October.......... | 89 | 3,002 | 13 | 29 |
| November.......... | 45 | 1,210 | 6 | 15 |
| December.......... | 24 | 621 | 2 | 2 |
| Total.......... | 523 | 14,575 | 90 | 150 |

BOUND UP.

| Month. | Number. | Net tons. | Vessels towed. | Unrigged towed. |
|---|---|---|---|---|
| March.......... | 22 | 450 | .......... | .......... |
| April.......... | 26 | 630 | 5 | 2 |
| May.......... | 46 | 1,305 | 11 | 13 |
| June.......... | 78 | 2,086 | 21 | 13 |
| July.......... | 68 | 1,708 | 24 | 30 |
| August.......... | 60 | 1,669 | 10 | 24 |
| September.......... | 61 | 1,764 | 14 | 29 |
| October.......... | 94 | 3,233 | 12 | 40 |
| November.......... | 45 | 1,212 | 11 | 13 |
| December.......... | 21 | 550 | 2 | 1 |
| Total.......... | 521 | 14,607 | 110 | 165 |

| | |
|---|---|
| Total number of trips made through the canal by tugs for whole season | 1,044 |
| Total number of net tons | 29,182 |
| Total number of vessels towed | 200 |
| Total number of unrigged craft towed | 315 |
| Total number of vessels and unrigged craft towed | 515 |
| Average net tonnage of tugs stationed at the canal | 28 |
| Average number passing through canal per day for whole season | 4.08 |
| Number of tugs stationed at canal engaged in local towing | 4 |
| Tonnage of tugs stationed at the canal for local towing | 112 |
| Length of towing route from harbor entrance to mouth of Sturgeon Bay, miles | 8.75 |

*Statement of class and net tonnage of vessels coming in from the lake via the canal during the year to seek shelter in Sturgeon Bay from storms.*

| Month. | Steam. | | Sail. | | Unrigged. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Number. | Net tons. | Number. | Net tons. | Number. | Net tons. | Number. | Net tons. |
| January | 3 | 2,385 | | | | | 3 | 2,385 |
| February | 1 | 846 | | | | | 1 | 846 |
| March | 4 | 2,910 | 2 | 495 | | | 6 | 3,405 |
| April | 11 | 4,650 | 23 | 2,804 | 2 | 2,463 | 36 | 9,917 |
| May | 7 | 2,226 | 36 | 5,603 | 1 | 1,463 | 44 | 9,292 |
| June | 4 | 1,968 | 30 | 3,488 | | | 34 | 5,456 |
| July | 3 | 1,424 | 19 | 1,585 | 1 | 1,463 | 23 | 4,472 |
| August | 9 | 3,276 | 14 | 854 | 7 | 4,950 | 30 | 9,080 |
| September | 6 | 1,256 | 21 | 2,309 | | | 27 | 3,565 |
| October | 9 | 3,462 | 17 | 1,376 | 3 | 4,426 | 29 | 9,264 |
| November | 24 | 16,333 | 23 | 3,868 | 5 | 6,789 | 52 | 26,990 |
| December | 12 | 7,404 | 2 | 528 | 3 | 4,426 | 17 | 12,358 |
| Total | 93 | 48,140 | 187 | 22,910 | 22 | 25,980 | 302 | 97,030 |

| | |
|---|---|
| Average net tonnage of steam craft sheltered | 517.63 |
| Average net tonnage of sail craft sheltered | 122.51 |
| Average net tonnage of unrigged craft sheltered | 1,180.90 |

*Class, quantity, and estimated value of cargoes carried by vessels while sheltered in Sturgeon Bay, season of 1903, only those coming in from the lake via the canal being included.*

| Items. | | Quantity. | Price per unit. | Total valuation. |
|---|---|---|---|---|
| Coal | tons | 12,500 | $4.50 | $56,250 |
| Fish | do | 475 | 100.00 | 47,500 |
| Fruit | do | 300 | 60.00 | 18,000 |
| Iron: | | | | |
| Manufactured | do | 3,105 | 75.00 | 232,875 |
| Pig | do | 2,050 | 30.00 | 61,500 |
| Grain: | | | | |
| Barley | bushels | 68,000 | .45 | 30,600 |
| Oats | do | 120,000 | .40 | 48,000 |
| Wheat | do | 125,000 | .75 | 93,750 |
| Lumber | M feet B. M. | 24,225 | 25.00 | 605,625 |
| Merchandise (general) | tons | 3,405 | 175.00 | 595,875 |
| Poles (telegraph) | number | 16,800 | 4.00 | 67,200 |
| Stone (building and crib) | tons | 22,500 | .95 | 21,375 |
| Ties (railroad) | number | 41,000 | .30 | 12,300 |
| Wood | cords | 3,200 | 6.00 | 19,200 |

| | |
|---|---|
| Total estimated value of cargo carried by craft sheltered | $1,910,050 |
| Total estimated value of vessels sheltered (based on Lloyd's valuation and is approximate) | 3,979,110 |
| Total value of vessels and cargo | 5,889,160 |

*Principal lines of transportation using the canal during the past year and number and net tonnage of boats comprising each line.*

| Name of line. | Port of hail. | Number of boats. | Net tonnage. |
|---|---|---|---|
| Toledo, Ann Arbor and Northern Michigan Railroad Co. | Toledo, Ohio | 3 | 3,959 |
| Lackawanna Transportation Co | Buffalo, N. Y | 2 | 2,860 |
| Lake Michigan Car Ferry Transportation Co | Chicago, Ill | 4 | 3,723 |
| Goodrich Transportation Co | do | 7 | 5,411 |
| Edward Hines Lumber Co | do | 7 | 2,453 |
| Arthur Gurley Lumber Co | do | 4 | 1,361 |
| John Schroeder Lumber Co | Milwaukee, Wis | 3 | 699 |
| Hart's Steamboat Line | Green Bay, Wis | 3 | 1,315 |
| Leathem & Smith Towing and Wrecking Co | Sturgeon Bay, Wis | 16 | 6,778 |
| Packard, Smith & Co | do | 1 | 796 |
| Termensen & Jensen | do | 5 | 1,730 |
| Total |  | 55 | 31,085 |

Of the above lines of transportation the Toledo, Ann Arbor and Northern Michigan Railroad Company, the Lackawanna Transportation Company, the Goodrich Transportation Company, and Hart's Steamboat Line carry both freight and passengers; the other lines freight only.

In addition to the above lines of transportation a large number of steam barges, sail vessels, and unrigged craft engaged in the general freighting business make use of the canal continually, going both ways during the season of navigation, and a large local business is done by tugs engaged in assisting sail vessels, unrigged craft, etc., through the canal.

## J J 5.

## OPERATING AND CARE OF STURGEON BAY AND LAKE MICHIGAN SHIP CANAL, WISCONSIN.

*Operations during the fiscal year.*—Operations have been confined to work incident to operating and care, examinations, keeping record of vessels and tonnage passing through the canal, and making necessary repairs for maintenance, including the removal of 234 linear feet of the south revetment and rebuilding it on the rectified line.

*Condition of the improvement.*—Navigation through the canal opened April 2, 1903. Closed on account of ice formation December 14, and was resumed April 11, 1904. There is a depth of about 20 feet below datum in the canal, and a contract is in force to increase its depth to 21 feet, to be completed by December 31, 1904. Work in furtherance of the contract was begun May 25, 1903, and has been so vigorously prosecuted that it is expected that it will be completed by July 12, 1904.

The governing depth of the through channel connecting Lake Michigan with Green Bay, of which the canal forms a part, is reduced to about 15.8 feet in consequence of shoal water in the draw of the bridge that spans Sturgeon Bay.

*Proposed operations.*—It is proposed to apply the funds for which an allotment is requested in maintenance, operating and care, and supervision of existing works.

In accordance with the provisions of section 4 of river and harbor act of July 5, 1884, a summary of expenditures is herewith given.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. M. C. Haney, mayor of Algoma, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 475 | 475 |
| Sail | 290 | 290 |
| Total | 765 | 765 |

*By all ways of transportation.*

[About two-thirds of which is by way of the harbor.]

| | Tons. |
|---|---|
| Exports | 81,958 |
| Imports | 35,785 |
| Total | 117,743 |

*Principal articles of export.*—Grain, cattle, cheese, hay, and general merchandise.

*Principal articles of import.*—Coal and coke, apples, iron and steel, lumber, saw logs, and general merchandise.

JJ 7.

## IMPROVEMENT OF KEWAUNEE HARBOR, WISCONSIN.

The natural condition of this harbor and project for its improvement is described, and references for more extended information are given in Annual Report of the Chief of Engineers for 1903, pages 481 and 1848.

For report on examination and survey see House Document No. 362, Fifty-sixth Congress, first session, and Annual Report for 1900, pages 3752–3758.

*Operations during the fiscal year.*—There were no operations other than those incident to care and supervision. Repairs were made to the dredging plant at the Government wharf and yard; soundings taken, and maps prepared and arrangements made for obtaining materials for repairs of piers.

*Condition of the improvement.*—The piers were built the full length contemplated and are in fair condition, with the exception of 1,100 linear feet that requires renewal above the water line.

The channel has the required depth of 15 feet below datum, with a minimum width of about 75 feet.

*Proposed operations.*—It is proposed to apply the funds available and the additional appropriation recommended for maintenance of existing works by making needed repairs to piers and in dredging. It is estimated that the funds available will admit of rebuilding 650 linear feet of the piers above the water line, and materials for the same have been ordered. For rebuilding the remaining 450 feet that now needs renewal, and to maintain existing works to June 30, 1906, the following estimate is submitted:

| | |
|---|---|
| For rebuilding 450 feet of pier above the water line, at $10 | $4,500 |
| For minor repairs to piers | 1,000 |
| dredging 20,000 cubic yards, at 10 cents | 2,000 |
| ncies | 750 |
| | 8,250 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $8,562.11 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 253.79 |
| July 1, 1904, balance unexpended | 8,308.32 |
| July 1, 1904, amount covered by uncompleted contracts | 992.38 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 8,250.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| Act of— | |
|---|---|
| March 3, 1881 | $5,000.00 |
| August 2, 1882 | 12,000.00 |
| July 5, 1884 | 18,000.00 |
| August 5, 1886 | 10,000.00 |
| August 11, 1888 | 10,000.00 |
| September 19, 1890 | 20,000.00 |
| July 13, 1892 | 30,000.00 |
| August 18, 1894 | 20,000.00 |
| June 3, 1896 | $25,000.00 |
| March 3, 1899 | 8,800.00 |
| June 13, 1902 | 11,000.00 |
| Miscellaneous receipts credited to appropriations | 52.19 |
| Total | 169,852.19 |

Appropriated by local authorities in 1881 and expended by the United States under the direction of the engineer officer in charge, $8,042.72.

### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. Charles Metzner, mayor of Kewaunee, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 807 | 807 |
| Sail | 153 | 153 |
| Total | 960 | 960 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 570,401 |
| Imports | 211,696 |
| Total | 782,097 |
| Tonnage in calendar year ending December 31, 1902 | 1,007,565 |
| Decrease in 1903 | 225,468 |

*Principal articles of export.*—Flour, hay, mill stuffs, grain, potatoes, and general merchandise.

*Principal articles of import.*—Coal and coke, grain, lumber, and general merchandise.

## J J 8.

## IMPROVEMENT OF TWO RIVERS HARBOR, WISCONSIN.

The natural condition of this harbor and projects for its improvement are described and references for more extended information and maps are given in Annual Report of the Chief of Engineers for 1903, pages 481, 482, and 1850.

For report on examination and survey see House Document No. 45, Fifty-sixth Congress, first session. (Annual Report for 1900, p. 3759.)

*Operations during the fiscal year.*—Under contract with Frankman Bros. & Morris, pile revetments covering 1,069 feet of the north pier and 776 feet of the south pier were built, of which 374 feet was provided with timber superstructure and 1,471 feet was of dock construction. The cost of this work, exclusive of supervision, was $14,808.39.

The filling and riprapping of the north pier was done by hire of labor and the use of U. S. dredge *No. 1*, at a cost of $571.25, and of the south pier by hire of labor, for $438.68.

Soundings were taken and a map of harbor prepared.

*Condition of the improvement.*—May 3, 1904, a channel had the required depth of 13 feet below datum for a minimum width of about 140 feet. About 100 feet outside of the pierheads there was a small bar about 40 feet in width with a minimum depth of 12.8 feet. Probably no material change has occurred since then. About 200 linear feet of the inner end of the south pier requires renewal. The remaining portions of the piers are in fair condition.

*Proposed operations.*—It is proposed to apply available balance and additional appropriation recommended in repairing the piers and dredging for the maintenance of the channel.

For maintenance of existing works for the fiscal year ending June 30, 1906, the following estimate is submitted:

| | |
|---|---|
| For dredging 30,000 cubic yards, at 12 cents | $3,600 |
| For repairs to piers | 2,400 |
| Contingencies, 10 per cent | 600 |
| Total | 6,600 |

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $17,308.84 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 16,868.82 |
| July 1, 1904, balance unexpended | 440.02 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 6,600.00 |

### APPROPRIATIONS.

| Act of— | |
|---|---|
| March 3, 1871 | $25,000 |
| June 10, 1872 | 25,000 |
| March 3, 1873 | 25,000 |
| June 23, 1874 | 15,000 |
| March 3, 1875 | 15,000 |
| August 14, 1876 | 5,000 |
| June 18, 1878 | 10,000 |
| March 3, 1879 | 20,000 |
| June 14, 1880 | 20,000 |
| March 3, 1881 | 15,000 |
| August 2, 1882 | 15,000 |
| July 5, 1884 | $8,000 |
| August 11, 1888 | 2,500 |
| September 19, 1890 | 3,000 |
| July 13, 1892 | 3,000 |
| August 18, 1894 | 3,000 |
| June 3, 1896 | 5,000 |
| March 3, 1899 | 8,000 |
| June 13, 1902 | 20,000 |
| Total | 242,500 |

---

### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by the mayor of Two Rivers, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 121 | 121 |
| Sail | 59 | 59 |
| Total | 180 | 180 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 31,776 |
| Imports | 76,497 |
| Total | 108,273 |
| Tonnage in calendar year ending December 31, 1902 | 20,200 |
| Increase in 1903 | 88,073 |

*Principal articles of export.*—Hay, peas, cheese, wooden ware, and furniture.

*Principal articles of import.*—Coal and coke, saw logs, stone, lumber, and wood.

---

## J J 9.

## IMPROVEMENT OF MANITOWOC HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described, and reference for more extended information and maps are given in Annual Report of the Chief of Engineers for 1903, page 482.

For reports on examinations and surveys see House Documents No. 300, Fifty-fourth Congress, first session, and No. 233, Fifty-sixth Congress, first session. (See Annual Reports for 1900, p. 3761, 1901, p. 2979, and for 1903, pp. 1880-1883.)

*Operations during the fiscal year.*—Under contract with Mr. Adolph Green the breakwater was extended 400 feet in an easterly direction by 4 cribs, each 100 by 24 by 22½ feet, on pile foundation. This work completed the approved project, at a cost of $36,243.07, exclusive of supervision.

Minor repairs were made to the pierheads and the north pierhead protection and a small quantity of additional riprap deposited. Repairs are in progress to the outer crib of the south pier that was seriously injured by a vessel colliding with it. For the restoration of the channel 10,857 cubic yards of material were excavated by U. S. dredge *No. 1* at a cost of 7.3 cents per cubic yard.

*Condition of the improvement.*—Soundings completed April 30, 1904, indicate that the 20-foot channel has a width of 140 feet; probably no material change has occurred since then.

*Proposed operations.*—It is proposed to apply available balances and additional appropriation recommended for maintenance of existing works by dredging and repairing the piers.

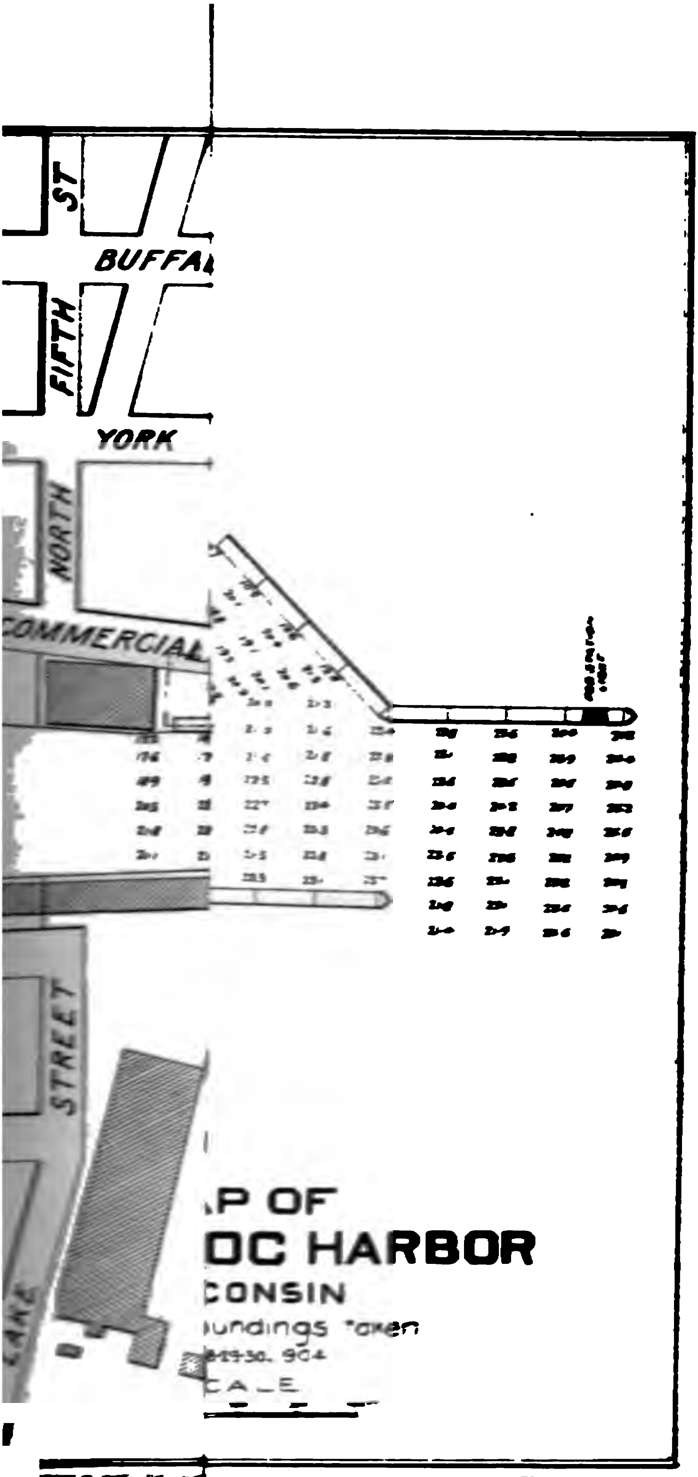
*Remarks and recommendations.*—The project for the improvement of this harbor is now completed, the breakwater having been extended the full length contemplated and the projected depth of 20 feet obtained in the channel. The harbor piers, however, are in urgent need of repairs, the greater part of the superstructure being very much dilapidated and requiring to be rebuilt above the water surface.

With the exception of the outer 500 feet of the south pier, the crib substructures of both piers are from 32 to 50 feet in length and are not provided with either pile or stone foundation, but rest directly on the lake bottom. The bottoms of these cribs are from 12 to 15 feet below datum, while the depth of channel is 20 feet. The cribs have settled out of line and level, it having been necessary in many places to drive piles along the sides of the piers on which to carry the present superstructure. The intervals between the cribs have opened, permitting sand to pass through, to the constant deterioration of the channel.

In order to secure a permanent channel, both piers should be provided with sheet piling along the channel sides. It is proposed to build substantial sheet-pile revetments, similar in construction to that now being built at Milwaukee. It is also proposed that when the superstructures of the piers are renewed, they shall be built of concrete in a manner similar to that now being done at Milwaukee. Considering the permanency of concrete as compared with the short life of timber, and also the tendency of the cost of concrete to diminish while the cost of timber increases, it is believed that whenever the commercial importance of a harbor has been established it is economy to reconstruct the superstructure of the piers with concrete.

The commercial importance of Manitowoc is now established and its permanency assured, it being the outlet for a constantly increasing commerce with the Northwest. It is therefore believed to be most economical to make the work of improvement already carried out by the Government as nearly permanent as possible.

The following is an estimate of the cost of rebuilding with concrete so much of the superstructure of both piers as will require renewal in the near future, including cost of sheet-pile revetment. The estimate is based upon prices now being paid under the contract for similar work at Milwaukee.



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28,000.00
20,000.00
44,440.00
3,300.00
45,000.00

252.72

448,812.72

| | | |
|---|---|---|
| North pier: | | |
| 875 linear feet, 20-foot pier, at $77.25 | $67,593.75 | |
| 750 linear feet, 24-foot pier, at $92.70 | 69,525.00 | |
| Total for north pier | | $137,118.75 |
| South pier: | | |
| 675 linear feet, 20-foot pier, at $77.25 | $52,143.75 | |
| 750 linear feet, 24-foot pier, at $92.70 | 69,525.00 | |
| Total for south pier | | 121,668.75 |
| Contingencies, superintendence, etc., including dredging for maintenance of channel | | 26,212.50 |
| Total | | 285,000.00 |

An appropriation of $285,000 for maintenance of existing works is recommended for the fiscal year ending June 30, 1906.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $43,758.53 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $37,000.00 | |
| For maintenance of improvement | 2,414.84 | |
| | | 39,414.84 |
| July 1, 1904, balance unexpended | | 4,343.69 |
| July 1, 1904, amount covered by uncompleted contracts | | 1,776.21 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | 285,000.00 |

APPROPRIATIONS.

| Act of— | |
|---|---|
| August 30, 1852 | $8,000.00 |
| June 23, 1866 | 52,000.00 |
| March 2, 1867 | 45,000.00 |
| July 25, 1868 (allotted) | 17,500.00 |
| April 10, 1869 (allotted) | 17,820.00 |
| July 11, 1870 | 20,000.00 |
| March 3, 1871 | 11,000.00 |
| March 3, 1873 | 20,000.00 |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 10,000.00 |
| August 14, 1876 | 8,000.00 |
| June 18, 1878 | 15,000.00 |
| March 3, 1879 | 6,500.00 |
| June 14, 1880 | 7,000.00 |
| March 3, 1881 | 4,000.00 |
| Act of— | |
| August 2, 1882 | $10,000.00 |
| July 5, 1884 | 15,000.00 |
| August 5, 1886 | 15,000.00 |
| August 11, 1888 | 8,000.00 |
| September 19, 1890 | 8,000.00 |
| July 13, 1892 | 28,000.00 |
| August 18, 1894 | 20,000.00 |
| June 3, 1896 | 44,440.00 |
| March 3, 1899 | 3,300.00 |
| June 13, 1902 | 45,000.00 |
| Miscellaneous receipts credited to appropriations | 252.72 |
| Total | 448,812.72 |

### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. W. G. Kemper, mayor of Manitowoc, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 1,824 | 1,828 |
| Sail | 257 | 257 |
| Total | 2,081 | 2,085 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 1,280,525 |
| Imports | 14,835,426 |
| Total | 16,115,951 |
| Tonnage in calendar year ending December 31, 1902 | 804,969 |
| Increase in 1903 | 15,310,982 |

*Principal articles of export.*—Grain, lime and cement, mill stuffs, and general merchandise.

*Principal articles of import.*—Coal and coke, furniture, brick, salt, wood, oil, and general merchandise.

## J J 10.

## IMPROVEMENT OF SHEBOYGAN HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described and reference for more extended information and for reports on examinations and surveys are given in Annual Report of Chief of Engineers for 1903, pages 483–484 and 1854.

*Operations during the fiscal year.*—Under contract with Nelson J. Gaylord for building 800 feet of pier extension, being the full length contemplated by the approved project, 400 feet were completed, and the remainder is well under way.

By hire of labor, of the 1,000 feet of the shore end of the north pier that was in need of urgent repairs, 680 feet were completed, leaving 320 feet yet to be done.

Of the 680 feet of the north pier removed, preparatory to rebuilding it on the rectified line, 120 feet were removed by U. S. dredge *No. 1* prior to June 30, 1903. During the fiscal year the remaining 560 feet were removed by the dredge, and the filling of the entire 680 feet with stone obtained from the old pier was also chiefly done by the dredge.

While not thus employed the dredge removed 32,277 cubic yards of material from the channel. The cost of the dredging per cubic yard was 11.4 cents.

Soundings were taken and a map of the harbor prepared.

*Condition of the improvement.*—Soundings completed May 21, 1904, indicated that a shoaling of from 1 to 2 feet had occurred in places since the close of dredging November 3, 1903. Between the harbor piers, with unimportant exceptions, there was a depth of 20 feet for a width of about 120 feet. Upon a bar extending from the pierheads easterly a distance of about 375 feet, the minimum depth in mid-channel was 19.7 feet.

It is expected that under the contract now in force, pier extension will be completed in October, 1904. The breakwater is 600 feet long and requires an extension of at least 100 feet.

*Proposed operations.*—It is proposed to apply available balances and additional appropriation recommended in completing the 21-foot channel by dredging and by pier extension, completing repairs to the north pier, extending the breakwater 100 feet in accordance with the approved project, and for maintenance of existing works.

The following estimate for completion of breakwater and maintenance of existing works for the fiscal year ending June 30, 1906, is recommended:

| | |
|---|---|
| For tearing out 320 linear feet old pier and building 320 linear feet of pile revetment, at $20 | $6,400 |
| For 1 crib, 30 by 100 feet, to complete existing project for breakwater | 11,500 |
| For dredging 40,000 cubic yards, at 15 cents | 6,000 |
| For minor repairs to piers and breakwater | 2,500 |
| Contingencies and superintendence | 2,600 |
| Total | 29,000 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $86,231.77 |
| Miscellaneous receipts | | 91.63 |
| | | 86,323.40 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $31,632.52 | |
| For maintenance of improvement | 9,897.77 | |
| | | 41,530.29 |
| July 1, 1904, balance unexpended | | 44,793.11 |
| July 1, 1904, outstanding liabilities | | 200.00 |
| July 1, 1904, balance available | | 44,593.11 |
| July 1, 1904, amount covered by uncompleted contracts | | 39,684.20 |
| Amount (estimated) required for completion of existing project | | 11,500.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $11,500.00 | |
| For maintenance of improvement | 17,500.00 | |
| | | 29,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| August 30, 1852 | $10,000.00 | August 2, 1882 | $30,000.0 |
| June 28, 1864 (allotted) | 10,000.00 | July 5, 1884 | 28,000.0 |
| June 23, 1866 | 47,598.91 | August 5, 1886 | 15,000.0 |
| March 2, 1867 | 8,000.00 | August 11, 1888 | 15,000.0 |
| April 10, 1869 (allotted) | 14,850.00 | September 19, 1890 | 15,000.0 |
| July 11, 1870 | 15,000.00 | July 13, 1892 | 25,000.0 |
| March 3, 1871 | 15,000.00 | August 18, 1894 | 25,000.0 |
| June 10, 1872 | 18,000.00 | June 3, 1896 | 26,000.0 |
| March 3, 1873 | 10,000.00 | March 3, 1899 | 28,400.0 |
| June 23, 1874 | 10,000.00 | June 6, 1900 | 52,000.0 |
| March 3, 1875 | 12,000.00 | June 13, 1902 | 90,000.0 |
| August 14, 1876 | 6,000.00 | Miscellaneous receipts credited to appropriations | 91.6 |
| June 18, 1878 | 4,000.00 | | |
| March 3, 1879 | 3,000.00 | Total | 564,940.5 |
| June 14, 1880 | 7,000.00 | | |
| March 3, 1881 | 25,000.00 | | |

CONTRACT IN FORCE.

For construction of 200 feet north pier extension and 600 feet south pier extension, material to be paid for at the following rates: Foundation and protection pile at $9.50 each; stone at 85 cents per ton; Douglas or Oregon fir and longleaf yello or southern pine timber at $34 per thousand feet B. M.; hemlock timber at $23.7 per thousand feet B. M.; pine plank at $32 per thousand feet B. M.; hemlock plank at $20 per thousand feet B. M.; wrought-iron drift bolts at 3¼ cents per pound wrought-iron screw bolts at 3¾ cents per pound; wrought-iron and wire spikes at cents per pound.

Name of contractor: Nelson J. Gaylord.

Date of contract: March 30, 1903.

Date of approval: April 13, 1903.

Date of commencement: May 9, 1903.

Date for completion: December 31, 1903; waived.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. E. P. Ewer, Sheboygan, Wis., and Mr. Wm. H. Devos, collector of customs, Milwaukee, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 885 | 88 |
| Sail | 286 | 28 |
| Total | 1,171 | 1,17 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 648,23 |
| Imports | 702,81 |
| Total | 1,351,04 |
| Tonnage in calendar year ending December 31, 1902 | 65,78 |
| Increase in 1903 | 1,285,25 |

*Principal articles of export.*—Coal, furniture, malt, lumber, brick, beer, iron and steel, lime and cement, and general merchandise.

*Principal articles of import.*—Coal and coke, tan bark, cheese, lumber, shingles, oi and varnish, and general merchandise.

## J J 11.

## IMPROVEMENT OF PORT WASHINGTON HARBOR, WISCONSIN.

The natural condition of this harbor and projects for its improvement are described in the Annual Report of the Chief of Engineers for 1903, page 484. For more extended information and maps, see Annual Report for 1893, page 2740; 1896, page 2498, and 1903, page 1856.

For report on examinations and surveys, see House Documents No. 44, Fifty-sixth Congress, first session, Annual Report for 1900, page 3766, and No. 227, Fifty-eighth Congress, second session.

*Operations during the fiscal year.*—There were no operations other than taking soundings and preparation of map.

*Condition of improvement.*—The piers are built the full length contemplated and are in fair condition. The channel and basins have the required depth of 13 feet below datum.

*Proposed operations.*—It is proposed to apply the balance available for maintenance of existing works in dredging and for repairs to piers as may be needed from time to time.

It is believed that the funds available are sufficient for these purposes to June 30, 1906; therefore no estimate for an additional appropriation is submitted.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $5,626.94 |
| Miscellaneous receipts | 31.75 |
| | 5,658.69 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 7.25 |
| July 1, 1904, balance unexpended | 5,651.44 |

APPROPRIATIONS.

| Act of— | |
|---|---|
| July 11, 1870 | $15,000.00 |
| March 3, 1871 | 15,000.00 |
| June 10, 1872 | 15,000.00 |
| March 3, 1873 | 15,000.00 |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 10,000.00 |
| August 14, 1876 | 8,000.00 |
| June 18, 1878 | 5,000.00 |
| March 3, 1879 | 7,500.00 |
| June 14, 1880 | 20,000.00 |
| March 3, 1881 | 17,000.00 |
| August 2, 1882 | 17,000.00 |
| July 5, 1884 | 10,000.00 |
| Act of— | |
| August 5, 1886 | $5,000.00 |
| September 11, 1888 | 5,000.00 |
| September 19, 1890 | 3,000.00 |
| July 13, 1892 | 6,500.00 |
| August 18, 1894 | 5,000.00 |
| June 3, 1896 | 5,500.00 |
| March 3, 1899 | 4,400.00 |
| June 13, 1902 | 6,000.00 |
| Miscellaneous receipts credited to appropriations | 68.25 |
| Total | 204,968.25 |

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. Chas. A. Mueller, harbor master, Port Washington, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 283 | 280 |
| Sail | 72 | 72 |
| Total | 355 | 352 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 9,848 |
| Imports | 47,253 |
| Total | 57,101 |
| Tonnage in calendar year ending December 31, 1902 | 65,789 |
| Decrease in 1903 | 8,688 |

*Principal articles of export.*—Brick, chairs, hay, and woodenware.

*Principal articles of import.*—Tan bark, hides, lumber, saw logs, railroad ties, and wood.

## J J 12.

## IMPROVEMENT OF HARBOR AT MILWAUKEE, WISCONSIN, INCLUDING HARBOR OF REFUGE.

The natural condition of this work and projects for its improvement are described, and references for more extended information and for reports on examinations and surveys are given in the Annual Report for 1902, pages 446 and 2067, and House Document No. 120, Fifty eighth Congress, second session.

*Operations during the fiscal year.*—Under the existing contract for building about 2,450 linear feet of concrete superstructure on the breakwater and 1,050 linear feet of the same on north harbor pier, together with reenforcing the latter with pile protection, work on the breakwater was in progress at the beginning of the fiscal year and was continued until November 3, when it was suspended for the season. Work on the north harbor pier was commenced April 17, and work on the breakwater was resumed May 2, 1904. At the close of the fiscal year, work was in progress at both places, at which time 2,100 linear feet of the breakwater superstructure had been completed.

The old stone superstructure has been nearly removed from the north harbor pier, and other necessary work done preparatory to beginning concrete construction. Seventy-six foundation blocks have been made for the superstructure, but none have yet been placed.

A steam launch 50 feet long, for use in superintendence of the work, was built under contract with the Racine Boat Manufacturing Company at a cost of $5,000. The hull of the launch is of steel and it is provided with a 50-horsepower fore-and-aft condensing engine. A boathouse for housing the launch has been built adjoining the pile alongside the breakwater at a total cost of $1,595.58. The building is 28 feet wide, 60 feet long, and rests on a pile foundation. It is provided with a slip 11 feet wide and 53½ feet long in which to moor the launch. The foundation was driven under a contract with J. E. Hathaway & Co. at a cost of $854.84. The remainder of the work was done by hire of labor.

*Condition of the improvement.*—The harbor channel has the required depth of 21 feet below datum for a minimum width of 130 feet.

*Remarks.*—On the completion of the contract now in force the portion of the breakwater extending from the shore to the angle, a distance of 2,350 feet, will be provided with a permanent concrete superstructure.

The timber superstructure from the angle to the "fair-weather opening" so called, a distance of about 1,100 feet, and for a distance of about 800 feet south from the opening, is very much dilapidated, and those portions of the breakwater are in an unsafe condition by reason of decay. The timber superstructure should be removed and a concrete superstructure should be built at the earliest possible time.

For reasons fully set forth in a report submitted July 14, 1899, and also in Annual Report for 1901, page 2937, to which attention is invited, the "fair-weather opening," 400 feet wide, should be closed by sinking crib substructures on pile foundation and building concrete superstructure.

While the cost of the concrete superstructure now under contract is approximately $53 per linear foot, it is believed that the cost for those portions proposed to be built will be about $60 per linear foot, on account of the more exposed location.

Under contract now in force that portion of the north harbor pier extending from the shore to the light-keeper's dwelling, a distance of about 1,050 feet, will be provided with permanent concrete superstructure. The superstructure over the remainder of the north pier, about 600 feet in length and which has not been rebuilt since 1887, is very much dilapidated and should be rebuilt at once. It is proposed to rebuild it with concrete in a somewhat similar manner to the inshore portion, except that on account of the greater width of the pier and its more exposed location the work will be heavier.

The cribs constituting the substructure of this portion of the pier are only 50 feet long and are not provided with either pile or stone foundation, but rest directly on the natural lake bottom. The bottoms of the cribs are at a depth of about 15½ feet below datum, or 5½ feet above the bottom of the channel. It will be necessary, therefore, to protect the cribs from being undermined by building a substantial sheet-pile revetment along the channel face of the pier similar to that provided for the portion now under contract.

The estimated cost of the proposed work is as follows:

| | |
|---|---|
| Breakwater: | |
| 400 linear feet timber crib substructure, at $100 per linear foot | $40,000 |
| 2,300 linear feet concrete superstructure, at $60 per linear foot | 138,000 |
| Total for breakwater | 178,000 |
| Harbor: | |
| 600 linear feet concrete superstructure, including revetment, at $100 per linear foot | 60,000 |
| Contingencies, superintendence, etc | 22,000 |
| Total for both works | 260,000 |

At the present time there are 16 works of improvement, exclusive of the Fox River, located at 15 different harbors in this district, and which are distributed along the west shore of Lake Michigan and Green Bay between Waukegan, Ill., and Menominee, Mich., representing a coast line of nearly 300 miles. While all of these harbors are accessible by railway the route to some of them is circuitous and the train service poor, involving numerous delays and much loss of time.

Much difficulty has also been experienced in hiring suitable vessels for making various examinations and surveys that have been ordered from time to time by act of Congress, and in making examinations and surveys of uncharted reefs and shoals, and similar work.

It is believed that both the inspection and survey work of this district would be greatly benefited were a suitable steam vessel provided. Such a vessel should have cabin accommodations for a survey party in addition to quarters for the crew, and be provided with all necessary arrangements so that a survey party could live aboard the boat. It should be large enough to carry a small amount of material—timber, iron, etc.—that might be needed for making urgent repairs of a minor nature, and be provided with engines of power sufficient to make not less than 12 miles per hour.

It is estimated that a steam vessel suitable for the foregoing purposes can be built and fully equipped for $40,000. As Milwaukee is the most important harbor in this district, as well as the district headquarters, the headquarters of the boat should be there likewise, and it is recommended that the sum of $40,000 be added to the appropriation for Milwaukee Harbor, Wisconsin, for constructing a suitable steam vessel for inspection and survey purposes in this district.

An appropriation of $300,000 is recommended for the fiscal year ending June 30, 1906, of which $260,000 is for maintenance and $40,000 is for an inspection and survey boat.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $250,428.43 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 91,449.25 |
| July 1, 1904, balance unexpended | 158,979.18 |
| July 1, 1904, amount covered by uncompleted contracts | 133,558.37 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 300,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

APPROPRIATIONS.

HARBOR.

*Expended on former mouth of Milwaukee River.*

**Act of—**

| | |
|---|---|
| **July 4, 1836** | **$400.00** |
| **March 3, 1843** | **30,000.00** |
| **" 11, 1844** | **20,000.00** |

*Straight cut.*

| | |
|---|---|
| Act of— | |
| August 30, 1852 | $15,000.00 |
| March 3, 1853 | 163.94 |
| June 23, 1866 | 48,283.51 |
| April 10, 1869 (allotted) | 35,640.00 |
| July 11, 1870 | 40,000.00 |
| March 3, 1871 | 38,000.00 |
| March 3, 1873 | 10,000.00 |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 25,000.00 |
| August 14, 1876 | 26,000.00 |
| June 18, 1878 | 15,000.00 |
| March 3, 1879 | 7,500.00 |
| June 14, 1880 | 10,000.00 |
| March 3, 1881 | 8,000.00 |
| August 2, 1882 | 10,000.00 |
| August 5, 1886 (from appropriation for harbor of refuge) | 4,737.91 |
| August 11, 1888 | 10,000.00 |
| March 17, 1890 (special act) | 6,100.00 |
| September 19, 1890 | 6,000.00 |
| July 13, 1892 | 14,000.00 |
| August 18, 1894 | 7,000.00 |
| June 3, 1896 | 7,000.00 |
| March 3, 1899 | 26,000.00 |
| Total expended at old river mouth and straight cut | 429,825.36 |
| Expended at former mouth of Milwaukee River | 50,400.00 |
| Total appropriated for straight cut (present harbor) | 379,425.36 |

HARBOR OF REFUGE.

| | | |
|---|---|---|
| Act of— | | |
| March 3, 1881 | | $100,000.00 |
| August 2, 1882 | | 100,000.00 |
| July 5, 1884 | | 85,000.00 |
| August 5, 1886 | $60,000.00 | |
| From which allotted to Milwaukee Harbor | 4,737.91 | |
| | | 55.262.09 |
| August 11, 1888 | | 70,000.00 |
| September 19, 1890 | | 80,000.00 |
| July 13, 1892 | | 75,000.00 |
| August 18, 1894 | | 45,000.00 |
| June 3, 1896 | | 20,000.00 |
| June 4, 1897 | | 168,737.91 |
| March 3, 1899 | | 50,000.00 |
| June 6, 1900 | | 105,650.00 |
| Miscellaneous receipts credited to appropriations | | 1,149.31 |
| Total | | 955,799.31 |
| Act of June 13, 1902 (harbor and harbor of refuge) | | 232,500.00 |
| Aggregate | | 1,618,124.67 |

CONTRACT IN FORCE.

For construction of 2,450 feet of concrete superstructure on breakwater, and 1,050 feet of concrete superstructure on north harbor pier, material to be paid for at the following rates:

Breakwater: Removing old superstructure and leveling cribs, at $7 per linear foot; Norway pine timber, at $40 per thousand feet B. M.; wrought-iron bolts and spikes, at 5 cents per pound; concrete blocks, at $9.25 per cubic yard; concrete in place, at $8.50 per cubic yard; stone, at $1.35 per ton.

North harbor pier: Removing old superstructure and leveling cribs, at $7 per linear foot; Norway pine timber, at $40 per thousand feet B. M.; white-oak timber, at

$60 per thousand feet B. M.; Norway pine sheet piles, at $40 per thousand feet B. M.; round piles, at 35 cents per linear foot; wire spikes, at 4 cents per pound; wrought-iron drift bolts and spikes, at 5 cents per pound; wrought-iron screw bolts and tie-rods, at 5 cents per pound; broken stone and gravel, at $1.75 per cubic yard; concrete blocks, at $9.25 per cubic yard; concrete in place, at $8.50 per cubic yard.

Name of contractor: William H. Gillen.
Date of contract: January 3, 1903.
Date of approval: January 15, 1903.
Date of commencement: February 18, 1903.
Date for completion: December 31, 1904.

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### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. W. J. Langson, secretary chamber of commerce, Milwaukee, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 4,840 | 4,836 |
| Sail | 645 | 649 |
| Total | 5,485 | 5,485 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 1,135,952 |
| Imports | 3,935,816 |
| Total | 5,071,768 |
| Tonnage in calendar year ending December 31, 1902 | 3,594,122 |
| Increase in 1903 | 1,477,646 |

*Principal articles of export.*—Grain, mill stuffs, flour, iron, malt, and beer.

*Principal articles of import.*—Coal, salt, grain, wood, cement, lumber, tan bark, and railroad ties.

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## J J 13.

## IMPROVEMENT OF SOUTH MILWAUKEE HARBOR, WISCONSIN.

See Annual Report of the Chief of Engineers for 1900, page 3701.

There were no operations since then other than the regular supervision. The act of June 13, 1902, provided for a—

> **Resurvey with a view to the modification of the present plan of said harbor, and with a view to ascertaining the feasibility and advisability of a harbor suitable for the needs of commerce at said port.**

**This survey was made and report thereon is printed in House Document No. 116, Fifty-eighth Congress, second session, and is printed herewith in Appendix J J 23.**

*Money statement.*

| | |
|---|---|
| **nce unexpended** | $12.10 |
| **unexpended** | 12.10 |
| **d for completion of existing project** | 133,000.00 |

APPROPRIATION.

| | |
|---|---|
| Act of June 3, 1896 | $5,000 |

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

The harbor is not available; therefore there are no imports or exports by water.

## J J 14.

## IMPROVEMENT OF RACINE HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described, and references for more extended information are given in Annual Report of the Chief of Engineers for 1903, pages 486 and 1862.

For reports on examinations and surveys see House Documents No. 326, Fifty-fourth Congress, second session; No. 165, Fifty-fifth Congress, third session; and Annual Reports for 1897, pages 2768–2772, and for 1899, page 2815.

*Operations during the fiscal year.*—No bid having been received in response to advertisement dated July 14, 1903, inviting proposals for moving cribs at southerly end of breakwater in accordance with approved project, the work was readvertised under date of February 9, 1904. The proposal of Bennett & Schnorbach was accepted and a contract entered into for moving two cribs. Work under this contract, which was begun May 7, 1904, was in progress at the close of the fiscal year, and has consisted in removing stone from the outer crib and in preparing new stone foundation. No crib has yet been moved.

*Condition of the improvement.*—Soundings taken April 18, 1904, indicated that the required depth of 21 feet below datum in the channel has decreased about 2 feet at the harbor entrance, the depth on the date specified being about 19 feet. Later soundings show a further shoaling, the minimum depth on the bar at the harbor entrance being 18 feet. About 750 feet of the south pier and 350 feet of the north pier require repairs. The remainder of the piers and the breakwater are in good condition, with the exception of the outer crib of the south pier that was recently injured by a steamer colliding with it.

*Proposed operations.*—It is proposed to apply available balance and additional appropriation recommended in taking up and resetting two cribs of the breakwater in accordance with the approved project, in dredging for the restoration of the channel, and in making necessary repairs to the piers. Arrangements are in progress for making immediate repairs to the outer crib of the south pier. Also for dredging on the bar at the harbor entrance to secure the required depth of 21 feet early in July, 1904.

*Remarks and recommendations.*—For reasons stated in Annual Report for 1903, page 1861, the recommendations there made are respectfully renewed.

*Estimate for maintenance of existing works for the fiscal year ending June 30, 1906.*

| | |
|---|---|
| For dredging 30,000 cubic yards, at 15 cents | $4,500 |
| For removing 1,100 feet of old crib pier and building pile pier in place thereof, at $40 per foot | 44,000 |
| For minor repairs to piers and breakwater | 2,500 |
| For contingencies | 5,000 |
| Total | 56,000 |

## *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $20,171.54 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 719.73 |
| July 1, 1904, balance unexpended | 19,451.81 |
| July 1, 1904, amount covered by uncompleted contracts | 17,397.10 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 56,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

### APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| June 15, 1844 | $12,500.00 | August 2, 1882 | $7,000.00 |
| August 30, 1852 | 10,000.00 | July 5, 1884 | 7,000.00 |
| June 28, 1864 | 3,600.00 | August 5, 1886 | 10,000.00 |
| June 23, 1866 | 23,910.00 | August 11, 1888 | 10,000.00 |
| March 2, 1867 | 45,000.00 | September 19, 1890 | 17,500.00 |
| April 10, 1869 (allotted) | 22,275.00 | July 13, 1892 | 25,000.00 |
| July 11, 1870 | 10,000.00 | August 18, 1894 | 20,000.00 |
| March 3, 1871 | 10,000.00 | June 3, 1896 | 27,000.00 |
| March 3, 1873 | 20,000.00 | March 3, 1899 | 50,000.00 |
| June 23, 1874 | 10,000.00 | June 6, 1900 | 67,650.00 |
| March 3, 1875 | 10,000.00 | June 13, 1902 | 20,000.00 |
| August 14, 1876 | 8,000.00 | Miscellaneous receipts credited to appropriations | 364.80 |
| June 18, 1878 | 10,000.00 | | |
| March 3, 1879 | 6,000.00 | | |
| June 14, 1880 | 6,000.00 | Total | 474,799.80 |
| March 3, 1881 | 6,000.00 | | |

### CONTRACT IN FORCE.

For taking up two cribs at southerly end of breakwater and replacing them on a line parallel with the north harbor pier—the material to be paid for at the following prices: For moving two cribs, $13,600; white oak protection piles, at $11.30 each; pulling and redriving piles, at $7 each; Norway pine, tamarack, or rock elm piles, at 26 cents per linear foot; Wakefield sheet piling of Norway pine plank, at $48 per M feet B. M.; Norway pine timber, at $34 per M feet B. M.; wrought-iron driftbolts, at 4 cents per pound; wrought-iron screw bolts and tie-rods, at 5 cents per pound; wrought-iron and wire spikes, at 4 cents per pound; wire rope, at 22 cents per linear foot; stone, at $1.30 per ton of 2,000 pounds.

Name of contractor: Bennett & Schnorbach.
Date of contract: April 8, 1904.
Date of approval: April 18, 1904.
Date of commencement: May 2, 1904.
Date for completion: November 16, 1904.

### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. E. L. Evans, Racine, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 1,227 | 1,228 |
| Sail | 146 | 136 |
| Total | 1,373 | 1,364 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 173,587 |
| Imports | 271,186 |
| Total | 444,773 |
| Tonnage in calendar year ending December 31, 1902 | 554,376 |
| Decrease in 1903 | 109,603 |

*Principal articles of export.*—Stone, iron and steel, coal, mill stuffs, and general merchandise.

*Principal articles of import.*—Coal, stone, lumber, furniture, potatoes, and general merchandise.

## J J 15.

## IMPROVEMENT OF KENOSHA HARBOR, WISCONSIN.

The original condition of this harbor and projects for its improvement are described and references for more extended information and maps are given in Annual Report of the Chief of Engineers for 1903, page 487.

*Operations during the fiscal year.*—There were no operations other than incident to care and supervision. Soundings were taken and a map of the harbor prepared. Proposals were also invited, in the usual manner, for taking up one or two cribs of the southerly end of the breakwater and resetting them as shown on map of Racine Harbor in Annual Report for 1903, page 1862. March 11, 1904, the date of opening, only one bid was received, it being as follows:

| | |
|---|---|
| For taking up one crib and resetting the same | $10,430.30 |
| For taking up two cribs and resetting the same | 17,880.30 |

There not being sufficient funds available for moving two cribs it was believed to be in the best interests of the improvement to await the experience to be gained by moving the cribs at Racine Harbor, the conditions being practically the same at both harbors.

*Condition of the improvement.*—Shoaling has occurred in places in the 21-foot channel and in the 20-foot basin, but not to an extent to require immediate dredging. The piers and breakwater are in good condition.

*Proposed operations.*—It is proposed to apply available balances and appropriation recommended in taking up and resetting two of the breakwater cribs in accordance with the approved project, to do such dredging as may be necessary to restore the required depth in channel and basin, and to make such minor repairs as may be needed to the piers and to the breakwater.

*Estimate for fiscal year ending June 30, 1906.*

| | |
|---|---|
| For taking up and resetting two breakwater cribs | $18,000 |
| For dredging 30,000 cubic yards, at 15 cents | 4,500 |
| For minor repairs to piers and breakwater | 2,500 |
| Contingencies, 10 per cent | 2,500 |
| Total | 27,500 |
| Less amount available | 17,475 |
| Amount recommended to be appropriated | 10,025 |

Of which $2,325 is for improvement and $7,700 for maintenance.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $17,784.03 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 309.03 |
| July 1, 1904, balance unexpended | | 17,475.00 |
| Amount (estimated) required for completion of existing project | | 2,325.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $2,325.00 | |
| For maintenance of improvement | 7,700.00 | |
| | | 10,025.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| March 15, 1844 | $12,500.00 | August 2, 1882 | $6,000.00 |
| March 3, 1845 | 15,000.00 | July 5, 1884 | 5,000.00 |
| August 13, 1852 | 10,000.00 | August 5, 1886 | 5,000.00 |
| June 23, 1866 | 75,461.41 | August 11, 1888 | 7,500.00 |
| April 10, 1869 (allotted) | 5,346.00 | September 19, 1890 | 17,500.00 |
| July 11, 1870 | 10,000.00 | July 13, 1892 | 15,000.00 |
| March 3, 1871 | 10,000.00 | August 18, 1894 | 15,000.00 |
| June 10, 1872 | 10,000.00 | June 3, 1896 | 24,000.00 |
| June 23, 1874 | 10,000.00 | March 3, 1899 | 50,000.00 |
| March 3, 1875 | 15,000.00 | June 6, 1900 | 135,000.00 |
| August 14, 1876 | 8,000.00 | June 13, 1902 | 5,000.00 |
| June 18, 1878 | 8,000.00 | Miscellaneous receipts credited to appropriation | 157.71 |
| March 3, 1879 | 5,000.00 | | |
| June 14, 1880 | 5,000.00 | | |
| March 3, 1881 | 5,000.00 | Total | 489,465.12 |

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. William H. Devos, collector of customs, Milwaukee, Wis.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 85 | 87 |
| Sail | 62 | 61 |
| Total | 147 | 148 |

**Efforts were [illegible] ports by way of the harbor, but none could [illegible]**

## J J 16.

### IMPROVEMENT OF WAUKEGAN HARBOR, ILLINOIS.

The original condition of the harbor and projects for its improvement are described, and references for more extended information and for report on examinations and surveys are given, in Annual Report of the Chief of Engineers for 1903, page 488.

*Operations during the fiscal year.*—Under the continuing contract in force with the Hausler & Lutz Towing and Dock Company for pier extension and building breakwater, the north pier was extended 1,000 feet and the south pier 600 feet. None of the extension has been provided with superstructure.

*Condition of the improvement.*—The channel between the piers and in the basin has a depth of 18 feet below datum. The minimum width of this channel is 50 feet.

*Remarks.*—With the exception of repairs to the older portions of the piers, the present project will be completed under the continuing contracts now in force.

In the estimate of cost of the present project, submitted in report of January 5, 1900, and published in Annual Report for 1900, page 3769, items for repairs were included as follows:

| | |
|---|---|
| Rebuilding 1,000 linear feet superstructure of south pier, at $10 | $10,000 |
| Repairing portions of present piers | 2,000 |
| 333⅓ cords stone for refilling piers, at $6 | 2,000 |
| Total | 14,000 |

Of this amount about $2,000 has already been expended in rebuilding a portion of the superstructure of the south pier, leaving a balance of about $12,000 still available for repairs.

The older portion of the south pier consists of 350 linear feet of narrow pile pier varying in width from 1 to 4 feet, and 1,280 linear feet of pile pier 16 to 20 feet wide. The narrow pile pier does not require immediate repairs, and 260 linear feet of the inshore portion of the 16-foot pile pier was provided with new timber superstructure in 1901 and is in good condition. The remainder of the old south pier, about 1,020 linear feet, is in need of immediate repairs.

The older portion of the north pile pier included in the present project consists of 392 linear feet 16 feet wide and 216 feet 20 feet wide, all of which needs rebuilding.

The method of repairs proposed in report of January 5, 1900, before mentioned, consisted primarily in cutting down the pile piers to the water surface and building a timber superstructure thereon. Further consideration and later examinations, however, have led to the conclusion that the proposed method of repairs would prove unsatisfactory and inadequate.

With the exception of about 240 linear feet of the south pier built in 1895, both pile piers are of faulty construction, being unprovided with wale timbers at the water surface. After the piles became cayed above the water surface the upper wales no longer held them lace, and many of them have been forced outward by the pressure one filling. In some places the piles have been found so far out of line as to leave large openings, through which the stone has passed to such an extent that the filling is now entirely below the water surface.

It would be practically impossible to bring all the piles back into line, owing to the pressure of the stone; in consequence numerous voids would be left through which the stone filling would pass.

It is therefore considered most economical and advantageous to entirely remove these portions and to build new pile piers provided with wales at the water surface. By so doing the piers will retain the stone filling and will be adapted for carrying a concrete superstructure should the latter become advisable in the future.

The extension to the south pier, built in 1895, was provided with wales at the water surface, and the piles are in good alignment. It is therefore proposed to build an ordinary superstructure of 12 by 12 inch timbers over this portion of the south pier.

The estimated cost of the proposed renewals and repairs is as follows:

| | |
|---|---|
| South pier: | |
| 780 linear feet pile pier 16 feet wide, at $50 | $39,000 |
| 124 linear feet superstructure 16 feet wide, at $10 | 1,240 |
| 116 linear feet superstructure 20 feet wide, at $11 | 1,276 |
| Total for south pier | 41,516 |
| North pier: | |
| 392 linear feet pile pier 16 feet wide, at $50 | 19,600 |
| 216 linear feet pile pier 20 feet wide, at $54 | 11,664 |
| Total for north pier | 31,264 |
| South pier as above | 41,516 |
| North pier as above | 31,264 |
| Contingencies, superintendence, etc | 7,220 |
| Total | 80,000 |
| Less amount available | 12,000 |
| Balance | 68,000 |

For the maintenance of existing works for the fiscal year ending June 30, 1906, an appropriation of $68,000 is recommended.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $336,082.46 |
| Amount appropriated by sundry civil act approved April 28, 1904 | | 5,000.00 |
| | | 341,082.46 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $70,640.57 | |
| For maintenance of improvement | 285.40 | |
| | | 70,925.97 |
| **July 1, 1904, balance unexpended** | | 270,156.49 |
| **July 1, 1904, amount covered by uncompleted contracts** | | 236,193.02 |
| **[Amount that can be profitably expended in fiscal year ending June 30, 1906, for mainte[illegible] of improvement, in addition to the balance un-[illegible]** | | 68,000.00 |

**[illegible] ments of sundry civil act of June [illegible] d harbor act of 1899.**

### APPROPRIATIONS.

| Act of— | |
|---|---|
| August 30, 1852, for breakwater (outer) | $15,000 |
| June 14, 1880 | 15,000 |
| March 3, 1881 | 15,000 |
| August 2, 1882 | 20,000 |
| July 5, 1884 | 20,000 |
| August 15, 1886 | 20,000 |
| August 11, 1888 | 25,000 |
| September 19, 1890 | 35,000 |
| July 13, 1892 | 25,000 |
| August 18, 1894 | 20,000 |
| June 3, 1896 | 20,000 |
| March 3, 1899 | $5,500 |
| June 13, 1902 | 100,000 |
| March 3, 1903 | 240,000 |
| April 28, 1904 | 5,000 |
| Total appropriation for harbor | 580,500 |
| Appropriation for outer breakwater (1852) | 15,000 |
| Total for present harbor | 565,500 |

### CONTRACTS IN FORCE.

For construction of 1,000 feet of north pier extension, 1,400 feet south pier extension, and 588 feet of breakwater, material to be paid for at the following rates: Foundation and protection piles, at $9 each; white oak foundation piles, at $12 each; stone, at 96 cents per ton; Douglas or Oregon fir and longleaf yellow or southern pine timber, at $32 per 1,000 feet B. M.; hemlock timber, at $25.75 per 1,000 feet B. M.; pine plank, at $32 per 1,000 feet B. M.; hemlock plank, at $25 per 1,000 feet B. M.; wrought-iron driftbolts, at 3¼ cents per pound; wrought-iron screw bolts, at 3¼ cents per pound; wrought-iron and wire spikes, at 3¼ cents per pound.

Name of contractor: Hausler & Lutz Towing and Dock Company.

Date of contract: March 30, 1903.

Date of approval: April 25, 1903.

Date of commencement: May 26, 1903.

Date for completion: December 31, 1904.

For construction of 770 feet of pile revetment, removing 935 feet of old pier, dredging 337,000 cubic yards of sand, mud, etc., and 25,000 cubic yards of hardpan and bowlders, the material to be paid for at the following rates: Norway pine, tamarack, or rock elm piles, at 30 cents per linear foot; white oak piles, at 37 cents per linear foot; Wakefield sheet piling of Norway pine plank, at $50 per 1,000 feet B. M.; white pine timber and plank, at $46.50 per 1,000 feet B. M.; wrought-iron driftbolts, at 4 cents per pound; wrought-iron screw bolts and tie-rods, at 4 cents per pound; wrought-iron and wire spikes, at 3¼ cents per pound; tearing out and removing a portion of old pier for $6,000; dredging sand, mud, etc., at 9 cents per cubic yard, and dredging hardpan and bowlders, at 25 cents per cubic yard.

Name of contractor: The Lydon & Drews Company.

Date of contract: March 30, 1903.

Date of approval: April 27, 1903.

Date of commencement: April 30, 1903.

Date for completion: December 31, 1904.

### COMMERCIAL STATISTICS FOR THE CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Furnished by Mr. W. W. Pearce, mayor of Waukegan, Ill.]

*Arrivals and departures of vessels.*

| Description. | Arrivals. | Departures. |
|---|---|---|
| Steam | 576 | 575 |
| Sail | 12 | 12 |
| Total | 588 | 587 |

*By way of the harbor.*

| | Tons. |
|---|---|
| Exports | 4,780 |
| Imports | 190,952 |
| Total | 195,732 |
| Tonnage in calendar year ending December 31, 1902 | 35,695 |
| Increase in 1903 | 160,037 |

*Principal articles of export.*—Coal and general merchandise.

*Principal articles of import.*—Coal, lumber, fence posts, and general merchandise.

---

## J J 17.

## IMPROVEMENT OF FOX RIVER, WISCONSIN.

The original condition, object of the improvement, projects, etc., are fully described in Annual Report of the Chief of Engineers for 1898, page 2339; 1902, page 2077.

Attention is invited to the report upon "Operating and care of locks and dams on Fox River, Wisconsin."

During the fiscal year ending June 30, 1904, navigation closed November 27, 1903, and reopened April 18, 1904.

*Operations during the fiscal year.*—The operations during the year consisted in improving Miller Bay, Calumet and Stockbridge harbors, Lake Winnebago, and dredging channel of upper Fox River.

For details, see accompanying report of Mr. L. M. Mann, assistant engineer.

*Remarks and recommendations.*—The approved project provides for widening and deepening the channel of the Fox River from Green Bay to Montello, 100 feet wide and 6 feet deep, and from Montello to Portage, 100 feet wide and 4 feet deep at mean low water.

During the past year the question of the propriety of enlarging and maintaining the United States levee at Portage, Wis., has again arisen, and as the State of Wisconsin, by its levee commission, is now engaged in the reconstruction of other levees in its immediate vicinity, some action is required to finally decide the same.

The first levees built at Portage were on the north side of the Wisconsin River, and are known as the Lewiston levees. These were built by the State of Wisconsin, the Chicago, Milwaukee and St. Paul Railway Company, and the United States, Congress having appropriated $3,000 in the river and harbor bill of 1882 to aid in this construction.

The effect of this work was to protect the railway embankment and generally turn the high water of the Wisconsin away from the upper Fox; at the same time, however, by deflecting the flood waters injury by overflow and cutting was caused on the south side of the river, and to obviate this the Caledonia levees were built on the south side of the river and below the Lewiston levees.

Following this and for similar reasons, the present United States levee was built on the north side of the river, and then the city levees on the south side.

The act of August 5, 1886, appropriated $6,000, "or so much thereof as may be necessary," etc., for the construction of a levee at Portage, Wis., "to prevent overflow of the Wisconsin River into the upper Fox River, so as to prevent injury to the Government works on Fox River."

This money was withheld until 1889 (Annual Report, Chief of Engineers, 1887, p. 2079), for the reason that "during the fifteen years of Government possession of the works on the Fox River no levee at Portage has ever been found to be or considered to be necessary to prevent injury to Government works on Fox River."

The act of August 11, 1888, set aside $6,000, or so much thereof as might be necessary for constructing a levee at Portage, Wis., to prevent the overflow of the Wisconsin River into the upper Fox River. The sum of $6,000 appropriated by the act of August 5, 1886, was made available for the same purpose, and the expenditure of both sums was made mandatory.

The levee was constructed on a right of way obtained under condemnation proceedings and paid for by the city of Portage. The date of completion was January 31, 1890, and the cost to the United States was $11,800.22.

In April, 1900, there occurred the first serious flood since the construction of these works and their combined effect, in raising the flood level by engorgement of the waters, was apparent.

This flood caused two breaks in the United States levee at points where it had been weakened by cattle crossings, and following these the lock at the lower end of the Portage Canal was damaged. Such damage was due in part to faulty construction and to the age of the work. and it is thought would not occur again under similar conditions.

It will be seen that so far as the levees themselves were concerned conditions had been continually changing since the building of the first one in 1883. Other conditions have changed also. In 1887 the Government abandoned the improvement of the Wisconsin River. If it was not apparent then it is apparent now that with this step the canal joining the Fox and Wisconsin rivers at Portage lost any value that it may have had as a factor in the development of the general navigation interests of the United States.

The existing project provides for a channel 100 feet wide and 4 feet deep from Montello to Portage, Wis., 30.45 miles, with three locks—one at Governor Bend, 6.34 miles from Portage; one at Fort Winnebago, 2.17 miles below, and one at Portage. The present channel, which is about 75 feet wide and 3½ feet deep at ordinary stage of water, is amply sufficient for all present purposes, and there is no prospective commerce which would in my opinion justify any further expenditure in widening or deepening it.

The canal and the two locks at its ends are the only works of the United States that have been or could be in any way injured if the United States levee were to be removed.

Aside from a few small pleasure craft there is absolutely no navigation of this part of the river, except by the floating plant under the direction of this office.

In view of these facts it is my opinion that the levee is no longer necessary for the protection of any interest of the General Government.

As has been stated above, however, the State of Wisconsin is at present engaged in reconstructing and raising the other levees in this vicinity. Such work will render the Government levee useless in the event of a flood, and it should also be cared for; therefore some provision should be made to enable those whose interests demand it to make necessary alterations and repairs. I have therefore the honor to recommend:

(1) That the levee at Portage, Wis., be abandoned by the United States, and that the site be deeded back to the city of Portage, the original purchaser.

(2) That the work of widening and deepening of the channel in the Fox River above Montello, Wis., be suspended until its necessity shall be shown by the demands of general commerce.

During the fiscal year ending June 30, 1905, work will be continued in improving Wolf River, in widening and deepening the channel of Fox River by dredging, and building an elevator dredge with conveyor, as provided for in river and harbor act of June 13, 1902.

For carrying out the approved project for widening and deepening the channel of Fox River by dredging, it is recommended that $50,000 be appropriated for the fiscal year ending June 30, 1906.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $73,705.44 |
| Miscellaneous receipts | 6,304.76 |
| | 80,010.20 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 9,389.08 |
| July 1, 1904, balance unexpended | 70,621.12 |
| July 1, 1904, outstanding liabilities | 669.00 |
| July 1, 1904, balance available | 69,952.12 |
| July 1, 1904, amount covered by uncompleted contracts | 39,000.00 |
| Amount (estimated) required for completion of existing project | 145,866.48 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 50,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| Act of— | |
|---|---|
| March 2, 1867, for snag boat on Wisconsin River | $40,000.00 |
| July 10, 1870, for improving Wisconsin River | 100,000.00 |
| June 10, 1872, for purchase of works on Fox River from Green Bay and Mississippi Canal Company | 145,000.00 |
| March 3, 1873, for improving Fox and Wisconsin rivers | 300,000.00 |
| June 23, 1874 | 300,000.00 |
| March 3, 1875 | 500,000.00 |
| August 14, 1876 | 270,000.00 |

| Act of— | |
|---|---|
| June 18, 1878 | $250,000.00 |
| March 3, 1879 | 150,000.00 |
| June 14, 1880 | 125,000.00 |
| March 3, 1881 | 125,000.00 |
| August 2, 1882 | 200,000.00 |
| July 5, 1884 | 160,000.00 |
| August 5, 1886, for improving Fox River | 56,250.00 |
| August 11, 1888, for improving Fox River | 100,000.00 |
| September 19, 1890, for improving Fox River | 100,000.00 |
| July 13, 1892, for improving Fox River | 75,000.00 |
| August 18, 1894, for improving Fox River | 37,500.00 |
| June 3, 1896, for improving Fox River | 37,500.00 |
| March 3, 1899, for improving Fox River | 27,500.00 |
| June 13, 1902 | 70,000.00 |
| Miscellaneous receipts credited to appropriations | 7,777.85 |
| Total | 3,176,527.85 |

### CONTRACT IN FORCE.

For building an elevator dredge with auxiliary conveyor, complete, delivered on Fox River, for $39,000.

Name of contractor: The Bucyrus Company.
Date of contract: May 6, 1904.
Date of approval: June 1, 1904.
Date of commencement: June 24, 1904.
Date for completion: May 1, 1905.

### COMMERCIAL STATISTICS.

*List of articles transported on Fox River, Wisconsin, during the season of 1903.*

| Articles. | Quantity. | Articles. | Quantity. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Beer | 75.00 | Lime | 223.50 |
| Brick | 14,942.50 | Live stock | 12.75 |
| Buggies | 19.25 | Logs | 183,598.50 |
| Butter and cheese | 98.00 | Lumber | 4,628.25 |
| Cement | 580.50 | Oil and vinegar | 89.25 |
| Clay | 4,127.25 | Paper | 145.00 |
| Coal | 62,550.50 | Potatoes | 29.00 |
| Cord wood | 9,256.00 | Pulp | 151.00 |
| Drain tile | 156.00 | Pulp wood | 26,764.00 |
| Farm machinery | 4.50 | Rags and chemicals | 723.00 |
| Flour, grain and mill stuffs | 3,443.25 | Salt | 1,576.25 |
| Furniture | 20.25 | Sand | 20,916.00 |
| General merchandise | 6,009.00 | Stone | 3,552.25 |
| Gravel | 5,932.00 | Sugar | 52.50 |
| Hay | 415.00 | | |
| Lath and shingles | 317.25 | Total | 300,307.00 |

Passengers, 72,820.

*List of boats navigating Fox River between Portage and Green Bay, Wis., 1903.*

| Name of boat. | Draft. | | Tonnage. | Class. |
|---|---|---|---|---|
| | *Ft.* | *in.* | | |
| Thistle | 2 | 4 | 127.00 | Steamer. |
| Le Fevre | 2 | 6 | 133.00 | Do. |
| Fashion | 3 | 6 | 94.00 | Do. |
| B. F. Carter | 4 | 0 | 110.00 | Do. |
| J. H. Marston | 4 | 6 | 150.00 | Do. |
| Evelyn | 2 | 8 | 150.00 | Do. |
| J. E. Leimer | 1 | 8 | 88.00 | Do. |
| Albatross | 3 | 0 | 55.00 | Do. |
| Belle | 3 | 0 | 90.06 | Do. |
| Fannie C. Hart | 12 | 0 | 394.00 | Steamer; between Green Bay and Depere only. |
| Eugene C. Hart | 10 | 0 | 451.00 | Do. |
| Harriet A. Hart | 11 | 0 | 554.00 | Do. |
| Soaphia Minch | 13 | 6 | .......... | Tow barge; between Green Bay and Depere only. |
| Pawnee | 13 | 2 | .......... | Steamer; between Green Bay and Depere only. |
| Beatty | 15 | 0 | .......... | Do. |
| Chauncy Hurlbut | 14 | 0 | .......... | Do. |
| John Denessen | 6 | 0 | 15.00 | Steam tug. |
| Nettie Denessen | 6 | 0 | 29.00 | Do. |
| H. O. Warren | 4 | 0 | 26.00 | Do. |
| M. D. Moore | 3 | 0 | 36.00 | Do. |
| S. W. Hollister | 3 | 0 | 32.00 | Do. |
| Boscobel | 2 | 8 | 38.00 | Do. |
| D. A. Cady | 3 | 0 | 50.00 | Do. |
| Volunteer | 6 | 0 | 17.00 | Do. |
| Erna | 6 | 6 | 14.00 | Do. |
| Sandy | 4 | 0 | 125.00 | Tow barge. |
| Long Tom | 5 | 6 | 210.00 | Do. |
| Bray | 5 | 6 | 210.00 | Do. |
| Pelton | 5 | 6 | 204.00 | Do. |
| Taylor | 5 | 6 | 200.00 | Do. |
| Morrison | 5 | 6 | 250.00 | Do. |
| Georgia | 6 | 0 | 78.00 | Sailing scow. |
| Lucy F | 3 | 0 | 6.00 | Gasoline yacht. |
| Okoboji | 4 | 6 | 10.99 | Steam yacht. |
| Anna M | 2 | 6 | 90.00 | Do. |
| Cambria | 4 | 0 | .......... | Do. |
| Irma | 3 | 6 | .......... | Do. |
| Nia | 3 | 6 | .......... | Do. |
| Swallow | 3 | 6 | .......... | Do. |
| Queen of the Lake | 3 | 6 | .......... | Do. |
| May Flower | 3 | 0 | .......... | Do. |

NOTE.—There are also a large number of small pleasure boats, both steam and gasoline, besides those mentioned.

*Number of lockages on Fox River, Wisconsin, for the calendar year 1903.*

| No. | Lock. | Lockages. | No. | Lock. | Lockages. |
|---|---|---|---|---|---|
| 1 | Depere | 843 | 16 | Appleton second | 358 |
| 2 | Little Kaukauna | 634 | 17 | Appleton first | 529 |
| 3 | Rapide Croche | 453 | 18 | Menasha | 864 |
| 4 | Kaukauna fifth | 539 | 19 | Eureka | 1,009 |
| 5 | Kaukauna fourth | 543 | 20 | Berlin | 298 |
| 6 | Kaukauna third | 541 | 21 | White River | 138 |
| 7 | Kaukauna second | 577 | 22 | Princeton | 132 |
| 8 | Kaukauna first | 570 | 23 | Grand River | 222 |
| 9 | Little Chute fourth[a] | 537 | 24 | Montello | 75 |
| 10 | Little Chute third[a] | 537 | 25 | Governor Bend | 200 |
| 11 | Little Chute second | 490 | 26 | Fort Winnebago | 252 |
| 12 | Little Chute first | 492 | 27 | Portage | 107 |
| 13 | Cedars | 493 | | | |
| 14 | Appleton fourth | 492 | | Total | 12,287 |
| 15 | Appleton third | 362 | | | |

[a] Combined.

### REPORT OF MR. L. M. MANN, ASSISTANT ENGINEER.

United States Engineer Office,
Fox River Improvement,
*Oshkosh, Wis., June 30, 1904.*

Major: I have the honor to submit the following report of operations on "Improving Fox River, Wisconsin," from Portage to Green Bay, for the fiscal year ending June 30, 1904:

The work done during the year consisted in completing improving Miller Bay; protecting the banks of the basin at Stockbridge Harbor and dredging the basin; dredging an entrance channel and turning basin at Calumet Harbor, and dredging channel Upper Fox River.

### IMPROVING MILLER BAY, LAKE WINNEBAGO.

This work, commenced during the last fiscal year, was continued and completed August 11, 1903. The breakwater is 300 feet in length and extends in a northwesterly direction from the point of land at south side of the bay and forms a large basin in the bay, which was dredged to a depth of 6 feet below the plane of the crest of the Menasha dam. Several shoals outside the basin and in the entrance to the bay were removed. The sides of the breakwater were further riprapped below low water; the earth bank above water was then sloped and shaped and then paved from low water to the top, which is 5 feet above the plane of the crest of Menasha dam. The method of doing this work was very cheap, and the breakwater has stood very well after a severe test last winter.

### STOCKBRIDGE HARBOR.

For the purpose of protecting the banks and United States property, the banks having caved considerably, piles were driven 5 feet apart along the east and south sides of the basin, behind which brush and stone were placed. The banks all around the basin were sloped at an angle of about 45° and paved with stone; four spring piles were driven along the west revetment. The basin, having filled in some, was redredged to a depth of 6 feet below the plane of the crest of Menasha dam. The work was completed May 14, 1904.

### CALUMET HARBOR, EAST SHORE LAKE WINNEBAGO.

In accordance with the approved project for the improvement of this harbor, an entrance channel 100 feet in width and 7 feet in depth was dredged outside the mouth of the creek from the 7-foot contour in Lake Winnebago to the shore line. In the creek a channel was dredged from 60 to 80 feet in width and 6 feet deep, terminating in a turning basin 350 feet long by 200 feet at widest point. This work was commenced August 12, 1903, and was completed June 13, 1904. This dredging affords a fine harbor at this place and has greatly increased the transportation business on Lake Winnebago, and has been of great benefit to the residents along that shore.

### DREDGING UPPER FOX RIVER.

In accordance with the general project, dredging was continued for providing a channel 100 feet wide and 6 feet deep at mean low water by dredge *No. 5*. At the close of the last fiscal year, the channel had been completed from Princeton lock to a point 2,450 feet below milepost No. 52. The work was continued from this point downstream until September 19, when the dredge was withdrawn and assigned to other work. On June 12, 1904, work was resumed by dredge *No. 5* at this point and continued to the close of the fiscal year, completing the channel to a point 3,200 feet below milepost No. 51, where the dredge is now working.

The improved channel, with 6 feet available depth at mean low water, is completed in accordance with the project from Green Bay to a point 300 feet above milepost No. 43 (White River lock). From White River lock to Montello the available depth is 4 feet at mean low water, although for a distance of 1.8 miles below Princeton lock the 6-foot channel is completed, but not available until the channel is completed to White River lock. From Montello to Portage, the head of navigation of the Fox River, the available depth is 3 feet at mean low water.

On the Wolf River, a channel 4 feet deep at mean low water extends to New London, above which place no work has been done and is practically the head of navigation now.

A summary of the work done is shown in the accompanying tabulation of dredging:

*Tabulation of dredging.*

| Location. | Dimensions of cut. |  |  | Material dipped, measured in scow. |  | Character of material dredged. | No. of dredge. |
|---|---|---|---|---|---|---|---|
|  | Length. | Average width. | Average depth. | Handled. | Rehandled. |  |  |
|  | Feet. | Feet. | Feet. | Cu. yds. | Cu. yds. |  |  |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Clay and stone | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | Mud, clay, and gravel | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | do | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | .......... | Clay and stone | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | .......... | Sand, clay, and stone | [illegible] |
| Total | [illegible] |  |  | [illegible] | [illegible] |  |  |

The total amount of dredging done during the fiscal year was 112,193 cubic yards, which was dredged at an expense of $7,165.86, or at the rate of 6.39 cents per cubic yard.

Respectfully submitted.

L. M. Mann,
*Assistant Engineer.*

Maj. James G. Warren,
*Corps of Engineers.*

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## J J 18.

## OPERATING AND CARE OF LOCKS AND DAMS ON FOX RIVER, WISCONSIN.

The work during the fiscal year consisted principally in dredging bars and channels in the river, making repairs to locks, dams, canal banks, lock houses, dredges, and boats; rebuilding floor and upper wing walls of Rapide Croche lock; rebuilding Little Chute first lock into a masonry guard lock; repairs of Appleton Upper dam; repairs of Eureka lock, dam, and shore protection; repairs of Berlin and Princeton locks, and backing of Cedars and Montello dams.

For details of work done during the year see the report of Mr. L. M. Mann, assistant engineer, appended to this report.

It is again particularly to be noted that the continued enforcement of the rules and regulations for the navigation and use of the locks and canals on Fox River, approved by the Secretary of War, under river and harbor act of August 18, 1894, amended by act of June 13, 1902, has brought about a general condition which is far more satisfactory than ever before to all interests concerned.

A revocable license, dated July 10, 1899, was granted by the Secretary of War, permitting the Neenah and Menasha Water Power Company to place 8-inch flushboards on the Menasho dam on conditions previously agreed to by the company in writing. Flushboards were placed on the dam by the company from July 7 to 11; from July 24 to September 9, 1903, and from November 2, 1903, to February 5, 1904, when removed and not replaced to date.

An itemized statement of the expenditures during the year, required by section 4, river and harbor act of July 5, 1884, is appended hereto.

## *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $24,964.60 |
| Miscellaneous receipts | 69.86 |
| Amount allotted for fiscal year ending June 30, 1904 | 48,776.32 |
| | 73,810.78 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 50,861.52 |
| July 1, 1904, balance unexpended | 22,949.26 |
| July 1, 1904, outstanding liabilities | 4,497.50 |
| July 1, 1904, balance available | 18,451.76 |
| July 1, 1904, amount covered by uncompleted contracts | 502.50 |
| Amount allotted for expenditure in fiscal year ending June 30, 1905 | 31,117.60 |
| Amount available for fiscal year ending June 30, 1905 | 49,066.86 |

*List of allotments from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Fox River, Wisconsin.*

| | |
|---|---|
| August 9, 1884 | $54,000.00 |
| July 28, 1885 | 42,304.00 |
| July 20, 1886 | 43,668.00 |
| July 13, 1887 | 43,650.00 |
| June 28, 1888 | 48,900.00 |
| June 12, 1889 | 62,760.00 |
| November 25, 1889 | 13,500.00 |
| June 19, 1890 | 69,005.00 |
| April 28, 1891 | 63,980.00 |
| July 1, 1892 | 40,000.00 |
| July 15, 1893 | 32,430.55 |
| July 26, 1894 | 30,882.37 |
| July 20, 1895 | 61,279.63 |
| October 6, 1896 | 62,665.03 |
| July 30, 1897 | 60,009.62 |
| July 29, 1898 | $63,869.10 |
| October 4, 1898 | 3,000.00 |
| July 22, 1899 | 72,911.29 |
| January 6, 1900 | 2,000.00 |
| May 29, 1900 | 6,362.54 |
| July 20, 1900 | 78,167.11 |
| August 10, 1900 | 6,238.40 |
| July 19, 1901 | 54,563.57 |
| July 21, 1902 | 68,397.51 |
| October 4, 1902 | 2,750.00 |
| July 18, 1903 | 48,776.32 |
| Miscellaneous receipts credited to appropriations | 197.45 |
| Total | 1,136,267.49 |

*Summary of expenditures made from appropriation for operating and care of canals and other works of navigation (indefinite), act of July 5, 1884, applied to Fox River, Wisconsin, during the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Services | $33,099.27 |
| Supplies | 1,108.06 |
| Materials | 15,802.27 |
| Miscellaneous | 851.92 |
| Total | 50,861.52 |

### REPORT OF MR. L. M. MANN, ASSISTANT ENGINEER

United States Engineer Office,
Fox River Improvement,
*Oshkosh, Wis., June 30, 1904.*

Major: I have the honor to submit the following report of operations upon "Operating and care of canals and other works of navigation on Fox River, Wisconsin," from Green Bay to Portage, for the fiscal year ending June 30, 1904.

The work done during the year consisted principally in rebuilding the gates and repairing the floors of Berlin and Eureka locks; rebuilding Little Chute First lock into a masonary guard lock; providing steel spars, gas pipe hand rails and concrete tripod platforms for Berlin, Eureka, Cedars, and Kaukauna First locks; providing steel spars and gas-pipe hand rails for Little Chute Second lock; repairing floor and upper wing walls of Rapide Croche lock; repairing shore protection at Eureka dam: backing Montello and Cedars dams; making slight repairs to Montello, Grand River, Menasha, Appleton First, Second, Third, Little Chute combined, Kaukauna Fourth and Fifth, and Depere locks; Appleton Upper, Appleton Lower, Kaukauna, and Depere dams; Berlin, Menasha, Appleton Fourth, Kaukauna First and Second lock houses; special and general repairs to boats and dredges; new 50-foot scow; dredging bars and channels; general repairs to locks, dams, and canal banks, and care of works and property.

### MAINTENANCE OF NAVIGATION.

Navigation was formally closed on the Fox and Wolf rivers November 27, 1903, though boating was practically stopped on the night of the 17th, when the rivers froze up solid. It was again opened April 18, 1904, but the ice did not go out of Lake Winnebago until the 27th.

Princeton lock was closed for repairs from September 21 to October 22, 1903; Berlin lock from Aprill 18 to May 11, 1904, and Eureka lock from June 11 to June 22, 1904.

The water in the lower Fox River and Lake Winnebago has been well maintained at the crest of the dams throughout the year, and no arrests for infringement of rule 12 of the regulations, etc., were necessary.

The stage in Lake Winnebago for 1903–4 was below the crest of Menasha dam ninety days.

On December 7, 1903, the honorable the Secretary of War, renewed the authority heretofore given to the Neenah and Menasha Water Power Company to draw the water 18 inches below the crest during the suspension of navigation in 1903–4. The water was carefully used, and the lowest point reached was 13¼ inches below the crest on March 13, and it again reached the crest on March 30.

The stages in Lake Winnebago were as follows:

| | | |
|---|---|---|
| Water below crest of Menasha dam | days.. | 90 |
| Water at or above crest of Menasha dam | do... | 276 |
| Maximum height in 1904, May 11 | | +3.42 |
| Maximum height in 1903, April 10 | | +3.25 |
| Maximum height in 1902, May 26 | | +3.28 |
| Maximum height in 1901, April 13 | | +3.17 |
| Maximum height in 1900, November 22 | | +2.87 |
| Maximum height in 1899, May 15 | | +3.25 |
| Lowest point reached March 13, 1904 | | + .71 |
| Mean high water for twenty-two years | | +3.05 |

The maximum discharge of river during the year, measured at Rapide Croche dam, which gives practically the whole flow, was 700,926 cubic feet per minute, May, 13, 1904.

The mean monthly discharges at Rapide Croche dam, which correspond closely to the discharges at Neenah and Menasha combined, for the year are as follows:

| Month. | Cubic feet per minute. | Month. | Cubic feet per minute. |
|---|---|---|---|
| 1903—July | 247,484 | 1904—February | 187,695 |
| August | 206,767 | March | 268,040 |
| September | 259,276 | April | 401,123 |
| October | 281,174 | May | 522,444 |
| November | 221,184 | June | 400,904 |
| December | 173,124 | | |
| 1904—January | 186,326 | Mean for year | 279,628 |

The largest previous discharge was 739,034 cubic feet per minute on May 29, 1902, since measurements were had at this place.

Flushboards were placed on Menasha dam from July 7 to 11, from July 24 to September 9, 1903, and from November 2, 1903, to February 5, 1904, inclusive, when they were removed and have not been replaced since. The mills were not obliged to close their wheels during the entire year, having an abundance of water, except for one day, August 2, when the water was drawn down at Appleton to permit the Atlas Paper Company to put in a fire protection pipe. The water in Lake Winnebago reached a stage requiring sluicing from April 13 to May 2, and from May 9 to June 22, 1904. This has been by far the longest period of sluicing on record, sixty-five days.

Gauge readings were calculated, tabulated, and platted, as were also the daily discharges of the river at different points, and record of rain gauges was kept.

### REPAIRS OF LOCKS, ETC.

*Depere lock.*—The gates were provided with gas-pipe hand rails; new top timbers were placed on lower right wing cribs. The walk and steps leading to storeroom and closet on west side of office was repaired. Completed May 24, 1904.

*Depere dam.*—The wall over first sluiceway was repaired, and new decking was placed on crib between second and third sluiceway. Repairs completed May 20, 1904.

*Rapide Croche lock.*—For the purpose of making the necessary repairs to this lock, the nature of which could not be fully determined until the lock was pumped out, cofferdams of hemlock timber backed with clay were placed above and below the lock. The lock was pumped out and repairs were made to floor and miter sills. The upper gates were provided with new top arms of fir timber, and decayed timber in the intermediate arms was renewed. The old valves were refitted; the gates fitted to the miter sills and new fenders placed on gates. The old valves were removed from the lower gates and new wrought-steel valves were placed. The gates were raised and fitted to the lower miter sills and new fenders were placed on gates. Checks were cut in the head walls for stop timbers. The upper wing walls, consisting of timber cribs filled with stone, being in bad condition, were removed, and wing walls of cement masonry were built in place of them. The masonry of the chamber walls was repointed with cement mortar. Repairs completed February 25, 1904. The cofferdams were removed by dredge *No. 4* on April 23, 1904. In May the tools and material left over were transferred to Kaukauna and stored.

*Kaukauna Fifth lock.*—The joints in the lower wing walls and in the top of the upper right retaining wall were repointed with Portland cement mortar. Repairs completed October 10, 1903.

*Kaukauna Fourth lock.*—The joints in the masonry revetment walls between the Fourth and Fifth locks were raked out and repointed with cement mortar. Work completed April 21, 1904.

*Kaukauna Second lock house.*—The walls and ceiling of dining room and hallway were cleaned, repaired, and painted; a wooden cistern was purchased and placed in the angle between main building and kitchen; eave troughs were purchased and placed on the roof of main building and wing, with conductor pipes leading to cistern. Repairs completed October 31, 1903.

*Kaukauna First lock house.*—The walls and ceiling of bedroom and hallway on first floor were repaired, cleaned, and painted. Repairs completed October 31, 1903.

*Kaukauna warehouse.*—The roof of lean-to on north side was reshingled with Eastlake tin shingles. Eave troughs were placed on the lock side of roof, with the necessary spouts and drain pipe for carrying the water into the canal. Repairs completed October 10, 1903.

*Kaukauna First lock.*—This lock was provided with steel gate spars, gas-pipe hand rails, and with concrete tripod platforms for three of the gates. One of the filling valves was closed permanently to allow the use of steel gate spar on the upper right gate. The lower gates and miter still were refitted. Repairs completed June 24, 1904.

*Kaukauna dam.*—Decayed plank in walk to sluiceways were replaced and all loose plank securely spiked.

*Little Chute combined locks.*—The dry walls of waste-weir ditch were repaired and the middle gates were refitted to miter sill.

*Little Chute Second lock.*—Steel spars and gas-pipe hand rails were provided for this lock and the wooden tripod platforms were rebuilt. A broken valve gear was replaced and cast-iron washers were placed on the suspension straps, completing repairs May 15, 1904.

*Little Chute canal bank.*—The bank of canal, above Second lock, was filled and riprapped with stone for a distance of 400 feet on the right and 170 feet on the left side. Repairs completed April 30, 1904.

*Little Chute First lock.*—This lock, which has been used many years only as a guard lock and being of composite construction, had become very much dilapidated. The present repairs consist in rebuilding the upper end of the lock into a guard lock. The walls are built of cut stone masonry with heavy rubble backing laid in Louisville cement, upon a leveling course of concrete, on the solid limestone foundation. The gates are of solid fir timber, operated with wooden spars and the old tripods, and are supplied with six butterfly filling valves. The wing walls are faced with cut stone above water surface, backed with rubble and laid in Louisville cement. The breast wall was rebuilt. The miter sill is supported by a masonry wall in which the anchor bolts were set for securing the sill. The new work was bonded to the remaining portion of the old lock with masonry. The old lower gates and miter sills were removed.

Work was commenced after the close of navigation in November, 1903. A cofferdam was built across the canal above the lock and the water drawn off the canal. A derrick was set up alongside the Chicago and Northwestern siding on south side of river opposite lock to handle stone received on cars, and a derrick was set up at the lock for handling stone and material on the work. The stone used was Duck Creek limestone from the quarry of M. Brunette, of Velp, Wis., who furnished it cut and ready to lay in the work. The courses of stone are alternately 2 feet 8 inches and 1 foot 9 inches wide and vary from 13½ to 17½ inches in thickness, with coping 18 inches thick by 4 feet 6 inches wide. The backing is of rubble masonry, composed of derrick rubble from the same quarry and of small rubble from the old lock walls. The walls are 9 feet 6 inches wide on the bottom, 4 feet 6 inches wide on top, and 14 feet 9 inches high, and are 38 feet in length, including 10 feet of wall below the center of hollow quoin. The right wing wall is 44 feet long and the left wing wall is 26 feet long.

On April 17, 1904, the cofferdam was partially removed, opening the lock to navigation. The work of repairs was completed June 8, 1904.

*Cedars lock.*—The lock walls were backed with earth on both sides. The gates were provided with steel spars and gas-pipe hand rails and three concrete tripod platforms. One of the filling valves was closed permanently to allow the use of steel gate spar on the upper right gate. Repairs completed June 30, 1904.

*Cedars dam.*—The joints in the face of the left abutment were repointed with Portland cement mortar. The dam was backed with 565 cubic yards of clay. Repairs completed November 20, 1903.

*Cedars Canal bank.*—The dry wall on right and left banks above lock were repaired by relaying stone that had become displaced. Repairs completed April 30, 1904.

*Appleton Fourth lock house.*—The roof of the main building and porch was reshingled with Eastlake tin shingles. Repairs completed October 10, 1903.

*Appleton Lower dam.*—Slight repairs were made to gates in sluiceways and walk. Completed September 30, 1903.

*Appleton Third lock.*—The tripod platforms were raised and leveled up, completing repairs September 30, 1903.

*Appleton Third lock house.*—A new porch or platform was built at rear of house, and a sash door leading thereto was placed in the kitchen; hard-wood floors were laid in sitting room and bedroom; slight repairs were made to front porch. Repairs completed September 30, 1903.

*Appleton Second lock.*—The tripod platforms were raised and leveled and some earth was placed for filling around the lock for soil. Repairs completed May 27, 1904.

*Appleton First lock.*—The joints in the masonry at lower left end of lock were repointed with Portland cement mortar; decayed plank and posts in the old lock below the feeder were removed and the left side was replanked. Repairs completed September 30, 1903.

*Appleton First lock house.*—The walls and ceilings of the living room and first and second floor bedrooms were cleaned, repaired, and painted. Completed October 20, 1903.

*Appleton Upper dam.*—Preparations were made in September, 1903, for repairing the crest of this dam with concrete. Stone was crushed and transported to Appleton First lock, and sand was purchased and delivered, but, owing to the high stage of water in the fall of 1903 and the spring of 1904, the work was necessarily deferred. Slight repairs were made to the timber work of the sluice gates and to the walk over same.

*Menasha lock.*—A dry wall about 50 feet in length was built above the upper right wing wall and the bank filled behind same; the upper ends of the upper wing walls were raised and leveled up and the faces repointed with Portland cement mortar; the lower wing walls were straightened, raised, and repointed where necessary. Repairs completed September 30, 1903.

*Menasha lock house.*—A doorway was cut between sitting room and bedroom and provided with a door. Repairs completed September 20, 1903.

*Eureka lock.*—The water was shut out of this lock by placing stop timbers in the head walls and throwing up a dike across the canal below the lock, closing the lock to navigation on June 12, 1904. A 10-inch centrifugal pump was placed and the lock pumped out. Considerable quicksand was encountered at the lower end of the lock and ran in freely, considerable of it being thrown out by the pump. To keep lock clear of water for a considerable length of time probably another pump would be required. The old filling valves were removed from the platform above upper gates, the openings closed, and the floor of platform repaired. The miter sills being sound but waterworn were trued up square and repaired with fir timber. The lock walls were repointed with Portland cement mortar and repaired, after which the stop timbers and the dike below the lock were removed and the lock opened to navigation June 22, 1904.

New solid fir timber gates were framed and provided with new wrought-steel valves, valve rods, tee bars, heel-post caps, yokes, etc. The balance of the ironwork used was old material on hand and that removed from the old gates, which were refitted and repaired. The lock was provided with steel gate spars, gas-pipe hand rails, and concrete tripod platforms. The repairs will be completed about July 12, 1904, putting it in good working order for many years.

*Eureka dam.*—The shore below the right abutment was protected with piles, brush, and stone for a distance of 270 feet. Slight repairs were made to a leaking valve in navigable pass. Repairs completed June 30, 1904.

*Berlin lock.*—After the close of navigation in November, 1903, the water was shut out of this lock by placing stop timbers in the head walls and by throwing up a dike below the lock. A 10-inch centrifugal pump was placed and the lock pumped out. The lock floor was cleaned and the platform above upper gates repaired and made water-tight. The miter sills were found to be sound but waterworn, and were trued up square and repaired with fir plank. The old gates were removed and new solid gates of fir timber were framed and placed, with new wrought-steel valves, valve rods, tee bars, etc., and using the balance of the irons from the old gates. The lower wing cribs were removed to low water and leveled off to receive a masonry superstructure. On December 30, 1903, work was suspended for the winter; it was again resumed April 21, 1904. The lock was again pumped out and the lower wings were built up with cement masonry to the top of the lock walls and faced with cut stone masonry above the water surface. The lock walls were repointed with Portland cement and repaired. On May 11 water was let into the lock and navigation was resumed May 12. The lock was provided with steel gate spars, gas-pipe hand rails, and concrete tripod platforms. The right bank below the lock was protected with stone. Repairs completed May 27, 1904.

*Berlin lock house.*—Slight repairs were made to chimneys. The north and west walls of the cellar were lined with a 4-inch brick wall, leaving an air space of 2 inches to prevent freezing; the fence along north boundary line was repaired with new posts; the road between lock and lock house was repaired and raised with cinders. A screen door was provided for kitchen. Repairs completed May 27, 1904.

*Princeton lock.*—Preparatory to making the necessary repairs to the miter sills and floor stop timbers were placed in the head walls and a dike was thrown up below the lock in September, 1903, and an attempt was made to pump out the lock, but owing to the high stage of the water and the strong seepage through the sand banks due therefrom the attempt was unsuccessful, though two 10-inch centrifugal pumps were used. The work was, therefore, suspended till a lower stage of water could be had. The stop timbers were removed, the dike taken out, and navigation resumed October 22, 1903. If possible it is proposed to do the work this season.

*Grand River lock.*—The fence along the north side of the United States road leading to highway was rebuilt. Gravel and clay were placed on the road extending across the United States property. Completed October 23, 1903.

*Montello lock.*—A tool house 12 feet wide by 16 feet long was built and material for a fence around the lock site, and for snubbing posts above and below the lock, was framed at Berlin lock, but as a boat for transporting the material was not available the work of placing them was not done.

*Montello dam.*—This dam was backed with gravel in October, 1903.

*Fort Winnebago lock.*—In removing the material from the left bank of canal above lock for filling around Portage lock a roadway was partly graded from the head of the lock to the highway along the left bank of canal.

*Portage lock.*—The head walls were repointed with Portland cement mortar. The sandy ground around the lock, extending from the lower end of the lock to the Wisconsin River above, was covered with earth and seeded down. Completed October 10, 1903.

### SHORE PROTECTION ON UPPER FOX RIVER.

*Sand bank below mile post 44.*—For the purpose of protecting this bank cedar piles and stone were purchased, but the work was not done, as a boat was not available for the work.

### GENERAL REPAIRS OF LOCKS, DAMS, AND CANAL BANKS.

*Little Kaukauna dam.*—The walk over sluiceways impaired by the ice in March was repaired.

*Kaukauna Third and Fourth locks.*—New valve stops were placed on upper platform and lower gates.

*Kaukauna Second lock.*—The roadway extending from First lock to dry dock was graveled with material removed from dry dock basin.

*Kaukauna cement shed.*—The roof of this building, which was damaged by storm, was repaired.

*Kaukauna dam.*—The walk over sluiceways, damaged by ice in March, 1904, was repaired.

*Little Chute combined locks.*—A steel spar, broken by a passing boat, was repaired. Broken valve gears on middle platform valves were repaired. New valve stops were placed around valves in upper and middle platforms. Slight repairs were made to upper wing walls and dry walls of outlet to waste-weir ditch.

*Little Chute Second lock.*—A wooden spar, broken by a passing boat, was replaced with an old wooden spar on hand.

*Little Chute canal bank.*—Earth was placed in sink hole at head of old Little Chute Second lock to stop leakage.

*Cedars lock.*—Sink holes back of lock walls were refilled, and clay covered with good soil and seeded.

*Appleton Fourth lock.*—Slight repairs were made to masonry in left head wall, and the joints repointed with cement mortar.

*Appleton revetment wall.*—The decayed timber and stone in crib wall outside of revetment wall was removed to 1 foot below crest of upper dam.

*Appleton Upper dam.*—A small break which occurred in January, 1904, was repaired by relaying loose masonry in cement mortar. Seams along the top were filled with grout.

*Menasha dam.*—Slight repairs were made to sluice gates Nos. 1 and 2.

*Princeton lock house.*—The roof of porch was reshingled with Eastlake tin shingles.

*Grand River.*—A break in right bank of river above Grand River lock, caused by high water in April, was temporarily repaired with brush, logs, hay, and sand.

*Portage levee.*—Men were employed during a flood in the Wisconsin River in September to keep the levee intact.

### DREDGING BARS AND CHANNELS.

To maintain a navigable channel and restore it to dimensions heretofore obtained, and in maintaining a channel where projected depth had not been obtained, bars were removed on the upper and lower Fox River, as shown in the following tabulation:

The following is a summary of the work done:

| Location. | Summary of cuts. | | | Material (dipper measurement). | | Character of material dredged. | Number of dredge. |
|---|---|---|---|---|---|---|---|
| | Length. | Average width. | Average depth. | Handled. | Rehandled. | | |
| | *Feet.* | *Feet.* | *Feet.* | *Cu. yds.* | *Cu. yds.* | | |
| Kaukauna Canal | 250 | 20–30 | 1 | 1,910 | 1,830 | Clay and stone | 4 |
| Bar below Eureka lock. | 2,400 | 15–35 | 1–2 | 5,020 | 2,740 | Sand | 4 |
| Do | 340 | 60 | 2–3 | 1,900 | | do | 5 |
| Bar below Berlin lock | 820 | 40–60 | 1.5–3.5 | 3,764 | 1,200 | do | 5 |
| At foot of Lake Apuckawa. | 1,750 | 60 | 3 | 13,740 | | Mud and sand | 5 |
| At head of Lake Apuckawa. | 1,050 | 60 | 2 | 4,180 | | Mud | 5 |
| Bar between mileposts 91, 92. | 550 | 60 | 1–2 | 1,870 | | Sand | 5 |
| Bar above milepost 97 | 825 | 60 | 1–2 | 2,660 | | Sand, clay, and gravel | 5 |
| Bar below Fort Winnebago. | 3,100 | 20–60 | 1 | 4,520 | | Sand | 5 |
| Total | 11,085 | | | 39,564 | 5,770 | | |

The total amount of dredging done during the fiscal year was 39,564 cubic yards, dipper measurement, at an expense of $2,323.95, or at the rate of 5.87 cents per cubic yard.

### SPECIAL REPAIRS TO PLANT.

*New 50-foot scow.*—A flat scow 50 feet long, 16 feet wide, and 3 feet deep, of Oregon fir, with corner rakes of white oak, was built under contract by Mr. George Ryan, of Oshkosh. This scow was completed and launched April 16, 1904, and is marked *No. 5.*

*Dredge No. 4.*—A rowboat for use of this dredge, 16 feet long, 4-foot beam, and 13 inches deep, was built under agreement by the Dunham-Fulton Gun Company, of Oshkosh. The boat was completed October 22, 1903.

### GENERAL REPAIRS OF PLANT—BOATS, DREDGES, ETC.

*Steam tug Fox.*—Two new tanks were placed on upper deck for hot and cold water in bathroom. On November 17 she was frozen in at Omro on her way down river. She was therefore laid up at that place for the winter. Early in April she was placed in commission and run to Berlin lock, where numerous minor repairs were made and the necessary painting was done. She was placed in dry dock at Kaukauna from May 4 to 11 and the seams in hull calked where necessary and the hull painted. On May 25 a broken crank shaft was repaired by shrinking a band of iron around the same.

*Steam tug Wolf.*—A new set of teeth were placed in core wheel in September, 1903. She was laid up at Kaukauna for the winter on November 30, 1903. In April repairs were made to brick lining of fire arch, fire front, and paddle wheels. The canvas covering of upper deck was removed and deck covered with tin. She was placed in dry dock and the seams in hull calked where necessary and the hull painted and the cabin painted inside and out. In May the core-wheel shaft, which had been twisted off in turning around, was replaced with a new shaft.

*Dredge No. 4.*—This dredge was laid up for the winter at Kaukauna November 21. In April a new sprocket sheave was placed on swinging shaft and the forward spud boxes were repaired. Other minor repairs were made and the necessary painting was done. She began work for the season on April 6.

*Dredge No. 5.*—This dredge was laid up for the winter at Berlin lock on November 28, 1903. In April extensive repairs were made to the Lancaster grapple and extra parts for same were purchased. The work of fitting out was commenced May 2. Various minor repairs were made and the necessary painting was done. She commenced work on May 11.

*Scow Eureka.*—This scow was placed in the dry dock at Kaukauna and repairs made to side and rake plank and one spud. Two new oak chocks were framed and placed. The seams where necessary were calked and pitched.

*Scow No. 6.*—A new spud was framed and placed in this scow.

*Open scow No. 3.*—Decayed rake plank were renewed and the seams were calked where necessary.

*Pile driver.*—The new timber frame commenced in June, 1903, was completed. The frame was set up on scow *Eureka*, and the engine house, pile-driver frame, and scow were painted.

Respectfully submitted.

L. M. Mann,
*Assistant Engineer.*

Maj. James G. Warren,
*Corps of Engineers.*

*Detailed statement of expenditures for fiscal year ending June 30, 1904*—Continued.

| Character of work, etc. | Item of expense. | Amount. | Total. |
|---|---|---|---|
| Special repairs to plant | Repairs to pile driver | $30.00 | |
| Do | Repairs of dredge No. 4 | 35.00 | |
| Do | Flat scow No. 5 (50-foot) | 890.00 | $955.00 |
| General repairs of plant, boats, dredges, machinery, etc. | Repairs of tug Fox | 737.40 | |
| Do | Repairs of tug Wolf | 926.53 | |
| Do | Repairs of scow Eureka | 126.08 | |
| Do | Repairs of scow No. 4 | 39.00 | |
| Do | Repairs of dredge No. 4 | 389.91 | |
| Do | Repairs of dredge No. 5 | 471.45 | |
| Do | Miscellaneous | 172.41 | |
| Do | Repairs of pile driver | 73.60 | |
| Do | Repairs of barge Princeton | 25.00 | 2,961.38 |
| General repairs to locks, dams, and canal banks. | Materials | 771.46 | |
| Do | Labor and transportation | 1,568.67 | 2,340.13 |
| Dredging bars and channels | Fuel, supplies, etc | 1,598.05 | |
| Do | Labor | 1,047.83 | 2,645.88 |
| Care of works and property | Watchmen, labor and transportation | 2,010.67 | |
| Do | Fuel for tugs Fox and Wolf | 78.00 | |
| Do | Traveling expenses of assistant engineer, etc. | 145.48 | |
| Do | Subsistence | 28.45 | |
| Do | Laundering bedding, etc., for tug Fox | 7.40 | |
| Do | Express charges | .70 | |
| Do | Job printing | 69.90 | |
| Do | Postage stamps | 2.00 | |
| Do | Warning sign on breakwater, Miller Bay. | 3.00 | 2,345.60 |
| Maintenance of navigation | Lockmasters' services | 7,231.50 | |
| Do | Gauge observer's services | 60.00 | 7,291.50 |
| Superintendence and contingencies | Salary of assistant engineer | 2,400.00 | |
| Do | Salary of junior engineer | 1,500.00 | |
| Do | Salary of superintendent | 1,800.00 | |
| Do | Salary of clerk | 1,440.00 | |
| Do | Salary of messenger | 480.00 | |
| Do | Mileage of officers | 65.73 | |
| Do | Rent of office, Oshkosh | 325.00 | |
| Do | Rent of telephones and tolls | 225.31 | |
| Do | Stationery | 85.14 | |
| Do | Rent of post-office box | 3.75 | |
| Do | Blueprint paper, etc | 13.52 | |
| Do | Telegrams | .55 | 8,339.00 |
| Total | | | 50,861.52 |

## J J 19.

## PRELIMINARY EXAMINATION AND SURVEY OF GLADSTONE HARBOR, MICHIGAN.

[Printed in House Doc. No. 165, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 8, 1903.*

SIR: I have the honor to submit herewith reports dated July 29, 1902, and July 2, 1903, with map,[a] and report supplementary thereto, dated September 29, 1903, by Maj. J. G. Warren, Corps of Engineers, on preliminary examination and survey, respectively, of Gladstone Harbor, Michigan, with a view to obtaining a channel 18 feet in depth, authorized by the river and harbor act approved June 13, 1902.

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[a] Not reprinted; printed in House Document No. 165, Fifty-eighth Congress, second session.

Major Warren presents a plan for improvement by dredging to a depth of 18 feet below low-water datum, which would be about 21 feet below the plane of reference of the map, at an estimated cost of $36,300. It is his opinion, concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers, that the harbor is worthy of the proposed improvement.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, under the provisions of sections 3 and 14 of the above-mentioned act, and in its report of September 16, 1903, the Board states that it is desirable for the United States to undertake the improvement of Gladstone Harbor to the extent of doing so much of the dredging proposed by the district officer in his report of July 2, 1903, as falls without a line drawn perpendicular to the axis of the ore dock through its outer end. The estimated cost of this work is $14,000, and the annual expense of maintenance not more than 10 per cent of the first cost; and the Board expresses the opinion in its further report of October 12, 1903, that such expenditures would be reasonable in view of the increased commercial facilities that would be afforded by the contemplated dredging.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### PRELIMINARY EXAMINATION OF GLADSTONE HARBOR, MICHIGAN.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., July 29, 1902.*

GENERAL: I have the honor to submit the following report upon a preliminary examination made at Gladstone Harbor, Michigan, in compliance with instructions contained in letter from Office of the Chief of Engineers, United States Army, dated June 23, 1902, and to comply with requirements of an item in section 14 of act approved June 13, 1902, which reads as follows:

> Gladstone Harbor, with a view to obtaining a channel eighteen feet in depth.

The harbor of Gladstone is situated on the western shore of Little Bay de Noquette, at the northerly end of Lake Michigan, and about 7½ miles north of Escanaba, Mich. The harbor is a natural one, consisting of an indentation of the bay, protected by a projecting point of land, so as to be completely landlocked, and affording safe moorings for vessels at all times.

While the main channel in Little Bay de Noquette will permit the passage of the deepest draft vessels on the lakes, being from 24 to 42 feet in depth, access to that portion of the bay constituting Gladstone Harbor is obstructed by shoals having about 14 to 15 feet of water over them, upon which deep-draft vessels frequently ground. These shoals also interfere with the free movements of vessels in the harbor, and so form an obstruction to general navigation.

The principal commerce is in connection with the Minneapolis, St. Paul and Sault Ste. Marie Railway. This railway company has built extensive wharves, ore docks, and grain elevators at this place, and during the season of navigation maintains a regular line of steamers plying between Gladstone and Lake Erie ports. Other important industries located at Gladstone are the Cleveland Cliffs Iron Company and the Northwestern Cooperage and Lumber Company.

The commerce of Gladstone, which is important, is almost entirely with Lake Erie ports, and the largest vessels on the Lakes arrive at this harbor. Some shipments of iron ore have been made to Chicago, but none so far during the present season. The local commerce of Gladstone is comparatively insignificant, the great bulk of the business originating elsewhere and simply passing through Gladstone, where it is transferred from cars to steamer or vice versa.

The harbor of Gladstone is closed by ice during the winter months, navigation being usually suspended about the 1st of December and not resumed until the middle of April or 1st of May.

The nearest harbor is Escanaba, Mich., which is also a natural harbor, and while the commerce of this latter place is large and important it is of a different class from that which passes through Gladstone. Escanaba has no tributary country to the west other than the iron mines of the Menominee and other nearby districts, while Gladstone is in direct railway communication with the entire West and Northwest.

The arrivals and departures of vessels and principal exports and imports by way of the harbor only, as reported by Mr. W. M. Kellie, superintendent of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company's docks at Gladstone, for the calendar year ending December 31, 1901, are:

| | |
|---|---|
| Arrivals | 433 |
| Departures | 433 |

*Exports.*

| | | |
|---|---|---|
| Iron ore | tons | 450,000 |
| Grain | bushels | 3,500,000 |
| Flour | barrels | 2,000,000 |

*Imports.*

| | | |
|---|---|---|
| Coal | tons | 300,000 |
| Salt | barrels | 40,000 |
| General merchandise | tons | 75,000 |

For the foregoing reasons, therefore, the harbor of Gladstone is considered worthy of improvement by the General Government in the manner indicated, and it is recommended that a survey be made to determine the location and extent of the shoals now obstructing general navigation, and the extent of the improvement that might properly be undertaken by the United States in the interest of general commerce. The estimated cost of the proposed survey is $650.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., July 30, 1902.*

Respectfully forwarded to the Chief of Engineers, U. S. Army.

I concur in the opinion and recommendations contained in the last paragraph of this letter.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 12, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 18, 1902.*

Respectfully returned to the Chief of Engineers.

The Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, current series, from the Headquarters, Corps of Engineers, under the provisions of section 3 of the river and harbor act of June 13, 1902, has examined and reviewed the within report of Maj. J. G. Warren, Corps of Engineers, on a preliminary examination of Gladstone Harbor, Michigan, with a view to obtaining a channel 18 feet in depth. This examination was ordered by the river and harbor act of June 13, 1902.

Major Warren considers the harbor worthy of improvement and recommends a survey to cost $650. His views and recommendations are concurred in by the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers.

It appears from the report that the commerce of the harbor is large and is not local in its character, and that it is impeded by shoals having 14 to 15 feet on them. The Board considers that the amount of commerce of the harbor is sufficient to justify the improvement indicated in the act, if it can be effected at a reasonable cost, and recommends that a survey, with estimate of cost, be made by the district officer, and that funds be allotted for the purpose as recommended by him. Upon receipt of the data obtained by the survey a conclusion as to the worthiness of the work can be reached.

For the Board:

A. MACKENZIE,
*Colonel, Corps of Engineers,*
*Senior Member of Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,  
*October 23, 1902.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Gladstone Harbor, Michigan, authorized by the river and harbor act of June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality be made as proposed.

G. L. GILLESPIE,  
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,  
*October 25, 1902.*

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,  
*Secretary of War.*

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## SURVEY OF GLADSTONE HARBOR, MICHIGAN.

UNITED STATES ENGINEER OFFICE,  
*Milwaukee, Wis., July 2, 1903.*

GENERAL: I have the honor to submit the following report of a survey and estimate of cost of improvement of Gladstone Harbor, Michigan, with a view to obtaining a channel 18 feet in depth, in accordance with requirements of section 14, river and harbor act approved June 13, 1902, together with a map of the survey.

The harbor of Gladstone is situated on the western shore of Little Bay de Noquette at the northerly end of Lake Michigan, and about 7½ miles north of Escanaba, Mich. The harbor is a natural one, consisting of an indentation of the bay, and is so protected by a projecting point of land as to be completely landlocked, thus affording safe moorings for vessels at all times.

While the main channel of Little Bay de Noquette will permit the passage of the deepest draft vessels on the lakes, being from 24 to 42 feet in depth, that portion of the harbor in the vicinity of the ore dock and flour warehouse of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company is obstructed by a shoal with a minimum depth of about 6 feet on it. Another shoal to the northeastward of the ore dock forms an obstruction to vessels approaching the ore dock from that direction.

These two shoals and the area proposed to be dredged are shown in red on the accompanying map. It is believed that if the areas shown are dredged to a depth of 21 feet below datum the movements of vessels in the harbor will be very much aided, and a cause of frequent groundings will be removed.

While the act specifies a depth of 18 feet, it is understood that this should be the actual minimum depth. The datum to which the soundings shown on map are referred is a plane 581.28 feet above mean tide at New York City. The datum plane adopted by the Lake Survey on the recently published charts of harbors, is the standard low-water datum, which is 578 feet above mean tide at New York, or 3.28 feet below the plane of reference of the map submitted herewith. It is therefore assumed that the depth of 18 feet specified in the act is below low-water datum, which would be about 21 feet below the plane of reference of the map.

To obtain a depth of 21 feet below datum over the areas shown in red will require the removal of about 220,000 cubic yards of material. This material is believed to be mostly sand and clay, and it is thought it can be dredged at a cost not to exceed 15 cents per cubic yard. The estimated cost of removing these shoal areas will then be—

| | |
|---|---|
| 220,000 cubic yards of dredging, at 15 cents | $33,000 |
| Contingencies, 10 per cent | 3,300 |
| Total | 36,300 |

The principal commerce of Gladstone is in connection with the Minneapolis, St. Paul and Sault Ste. Marie Railway. This railway company has built extensive wharves, ore docks, and grain elevators at this place, and during the season of navigation maintains a regular line of steamers plying between Gladstone and Lake Erie ports. Other important industries located at Gladstone are the Cleveland Cliffs Iron Company and the Northwestern Cooperage and Lumber Company.

The commerce of Gladstone is mostly with Lake Erie ports, and the largest vessels on the Great Lakes are engaged in it. The local commerce, originating and terminating at Gladstone, is comparatively insignificant. The great bulk of the commerce originates elsewhere, and simply passes through Gladstone, where it is transferred from cars to steamers, and vice versa.

The harbor of Gladstone is closed by ice during the winter, navigation being usually suspended about the first of December and not resumed until the middle of April or first of May.

The arrivals and departures of vessels and principal exports and imports by way of the harbor only, as reported by Mr. W. M. Kellie, superintendent of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company's docks at Gladstone, for the calendar year ending December 31, 1902, are:

| | |
|---|---|
| Arrivals of vessels | 290 |
| Departures of vessels | 288 |

*Exports.*

| | | |
|---|---|---|
| Iron ore | tons | 92,389 |
| Grain | bushels | 2,721,568 |
| Flour | barrels | 1,503,179 |

*Imports.*

| | | |
|---|---|---|
| Coal | tons | 186,831 |
| Salt | barrels | 31,062 |
| General merchandise | tons | 51,507 |

The harbor of Gladstone is considered worthy of the proposed improvement, which is in my opinion justified by the needs of present and prospective commerce.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., July 3, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that the harbor of Gladstone is worthy of improvement to the extent indicated herein.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*July 8, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., August 5, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of a survey of Gladstone Harbor, Michigan, "with a view to obtaining a channel eighteen feet in depth," the indorsement of the division engineer thereon, and other data available.

The commerce of this port for 1902 amounted to more than 500,000 tons. The estimated cost of removing the shoals which impede access to the docks is the comparatively small sum of $36,300. The district officer proposes to dredge these shoals to the depth of 21 feet below datum in order that there may be as much as 18 feet over them at all times. If dredging is to be done at this place, the Board believes it should extend to 21 feet below datum.

Harbor lines have not been established at this harbor, yet it is probable that a considerable part of the dredging proposed within would lie on the shore side of such lines should they be established. Having in mind the legal prohibition against dredging by the United States on the shore side of harbor lines, the Board is unable to recommend that the work proposed within should be carried out in its entirety. The establishment of harbor lines is recommended. The Board is of opinion that, when such lines have been established, it will be desirable for the United States to improve Gladstone Harbor to the extent of doing so much of the dredging proposed within as may lie on the channel or harbor side of those lines.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

### SUPPLEMENTARY REPORT ON SURVEY.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., September 29, 1903.*

GENERAL: I have the honor to acknowledge the receipt of letter from Office of the Chief of Engineers, United States Army, dated September 23, 1903, requesting further estimates of cost of dredging at Gladstone Harbor, Michigan.

The estimate of cost of dredging over that portion of the area proposed in my report of July 2, 1903, as falls without a line drawn perpendicular to the axis of the ore dock through its outer end, is—

| | |
|---|---|
| 85,000 cubic yards, at 15 cents | $12,750 |
| Contingencies, superintendence, etc | 1,250 |
| Total | 14,000 |

It is impossible to furnish at this time any accurate or reliable estimate of the cost of maintaining the depth required, as no dredging has ever been done at this harbor by the United States, and there is no information available on which to base such an estimate.

It is believed, however, that the cost of maintenance would be very small, and probably no further dredging would have to be done for some years. It is further believed that in no event would the cost of dredging for maintenance exceed 10 per cent, or $1,400 per annum.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., September 30, 1903.*

Respectfully forwarded to the Chief of Engineers.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

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## J J 20.

## PRELIMINARY EXAMINATION AND SURVEY OF MANISTIQUE HARBOR, MICHIGAN.

[Printed in House Doc. No. 429, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, January 13, 1904.*

SIR: I have the honor to submit herewith reports, dated July 30, 1902, and September 24, 1903, and reports supplementary thereto, by

## PRELIMINARY EXAMINATION OF MANISTIQUE HARBOR, MICHIGAN.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., July 30, 1902.*

GENERAL: I have the honor to submit the following report upon a preliminary examination made at Manistique Harbor, Michigan, in compliance with instructions contained in letter from Office of the Chief of Engineers, United States Army, dated June 23, 1902, and to comply with an item in section 14, of act approved June 13, 1902, and which reads as follows: "Manistique Harbor."

The harbor of Manistique is situated on the north shore of Lake Michigan and at the mouth of the Manistique River. The original depth at the mouth of the river was 8 feet. The Chicago Lumbering Company constructed two parallel slab piers, each about 1,600 feet long and 250 feet apart, and dredged a channel between them to a depth of 11 feet before any appropriation had been made by the Government.

In May, 1873, a detailed survey of and report on this harbor was made under the direction of Maj. D. C. Houston, Corps of Engineers, U. S. Army. (See Report of Chief of Engineers, 1873, p. 254.) The estimated cost of the proposed improvement was $290,000, and the conclusion derived from the survey was, "there are no facts tending to show that the general commerce of the country will be benefited by the improvement of this harbor."

In November, 1879, another examination was made of this harbor and report submitted under date of December 20, 1879 (see Report of Chief of Engineers, 1880, p. 1931), in which a small amount of dredging to be done by the United States was recommended.

The original project for the improvement of this harbor was adopted in 1880, and provided for dredging a channel between the piers already constructed by private parties, the channel to be 150 feet wide and 13 feet deep below the present datum, i. e., 3.06 feet below high water of 1838, or 581.28 feet above mean sea level, at an estimated cost of $6,000. For the purpose of carrying out this project, appropriations were made as follows:

| Act of— | |
|---|---|
| June 14, 1880 | $5,000 |
| March 3, 1881 | 1,000 |
| Total | 6,000 |

No other appropriations have ever been made for the improvement of this harbor by the United States.

In October, 1880, a survey of the harbor showed that the direction of the piers lay across the natural channel, and directly toward a reef having only about 10 feet of water over it. The company which had built the piers, and had also the contract for dredging, found it necessary at this time to renew about 330 feet of the west pier which had been washed away. The superintendent of the company was notified by the officer in charge, Maj. H. M. Robert, Corps of Engineers, U. S. Army, that the direction of the piers would have to be changed. The company declined to comply with this demand, and their contract was annulled.

Since then there has been no dredging done at this harbor by the

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 16, 1902.*

Respectfully returned to the Chief of Engineers.

The Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, under provisions of section 3 of the river and harbor act of June 13, 1902, has examined and reviewed the within report of Maj. J. G. Warren, Corps of Engineers, on a prelimary examination of Manistique Harbor, Michigan. This examination was ordered by the river and harbor act of June 13, 1902.

Major Warren considers the locality worthy of improvement, and recommends a survey to cost $750. His views and recommendations are concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers.

It appears from the report that the entrance to this harbor lies between piers constructed by private parties, that the United States has expended $6,000 in dredging between those piers, and that the piers are wrongly located with respect to the natural entrance channel. The company which had built them having declined to change the direction of its piers, no further dredging has been done by the United States.

The commerce of the harbor has increased greatly of late, local industries of importance having arisen and a car-ferry line having been established between Manistique and Frankfort.

The Board considers that the commercial importance of the harbor is sufficient to justify such improvement as can be made at a reasonable cost, and recommends that a survey with plan and estimate of cost of the proposed improvement be made by the district officer, and that funds be allotted for this purpose as requested by him.

A. MACKENZIE,
*Colonel, Corps of Engineers,*
*Senior Member of Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 23, 1902.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Manistique Harbor, Michigan, authorized by the river and harbor act of June 13, 1902.

Inviting attention to the report of the Board of Engineers of Rivers and Harbors, in the preceding indorsement, I recommend that a survey of the locality be made as proposed.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,
*October 25, 1902.*

Approved as recommended by the Chief of Engineers.

E. ROOT,
*Secretary of War.*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, October 2, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 29, 1903.*

1. Respectfully returned to the Chief of Engineers, United States Army.

2. The Board of Engineers for Rivers and Harbors has considered the accompanying report of the district officer, dated September 24, 1903, upon a survey and estimate of cost of improving Manistique Harbor, Michigan, and the indorsement of the division engineer thereon. On June 26, 1903, a committee of the Board made a personal inspection of the harbor and vicinity.

3. In third indorsement hereon the Board stated that it considers the commercial importance of this harbor sufficient to justify such improvement as can be made at a reasonable cost.

4. The estimated cost of the project proposed by the district officer is $492,000, and there appears to the Board no technical objection to this plan. In the opinion of the Board, however, the present and reasonably prospective commerce of this port is not sufficient to warrant the expenditure by the United States of so large a sum. The importance of the harbor is, however, increasing, and the Board believes it to be worthy of improvement by the General Government to a limited extent.

5. The Board therefore recommends that the district officer be directed to modify his project and estimate of cost to include only the following:

(*a*) The construction of the east pier between its present end and the breakwater;

(*b*) The renewal of the superstructure of the breakwater with concrete;

(*c*) The extension of the breakwater toward the L marked in blue pencil "A" as far as deemed expedient, having in mind the omission of all pier construction proposed by the district officer on the west side of the harbor; and

(*d*) So much of the dredging proposed by the district officer as lies outside of the 17-foot contour on the west side of the harbor mouth.

It is estimated by the Board that the work suggested by it will materially improve the harbor at a cost of about $150,000.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

[Eighth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 16, 1903.*

Respectfully returned to Major Warren, inviting attention to the report of the Board of Engineers for Rivers and Harbors, in the preceding indorsement, and with request that he prepare and submit the modified project and estimate outlined by the Board in paragraph 5 of its report.

* * * * * * *

By order of the Acting Chief of Engineers:

H. F. HODGES,
*Major, Corps of Engineers.*

[Ninth indorsement.]

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., November 19, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, the necessary record having been made.

The estimate under the modified project, as called for in * * * the preceding indorsement, will be prepared and submitted at an early date.

J. G. WARREN,
*Major, Corps of Engineers.*

[Tenth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 28, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with modified plan and estimate as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Eleventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 5, 1903.*

1. Respectfully returned to the Chief of Engineers, United States Army.

2. The Board has carefully reconsidered the project and estimate of the district officer, and the modified project suggested by the Board in seventh indorsement hereon.

3. After mature deliberation the Board remains of opinion that the sum proposed to be expended by the district officer—to wit, $492,000—is in excess of the expenditure that seems advisable when compared with the prospective benefits to commerce. On the other hand, further study shows that the plan suggested in the seventh indorsement is faulty in providing no west pier to intercept sand, which, moved along the beach by westerly winds, would be held by the proposed east pier within the limits of the area proposed to be dredged.

4. In view of the facts heretofore recited, believing that the commerce involved will experience advantages commensurate with the cost, the Board is of opinion that a project should be adopted to include only the following items of work recommended by the district officer in his report of September 24, 1903, on the survey of Manistique Harbor, Michigan, viz:

(*a*) On the east side of the harbor mouth, the pier connecting the shore with the old breakwater; the renewal of the superstructure of the latter with concrete, and its extension westwardly to the point of beginning of the proposed lake arm, marked A on map of the survey.

(*b*) On the west side of the harbor mouth, the construction of so much of the proposed pier as lies between the shore and the 17-foot contour of the lake.

(*c*) The dredging proposed, except over the area lying inside the present 17-foot contour on the west side of the entrance.

5. It appears that the work above described will cost not to exceed $250,000, but it is recommended that the district officer be requested to prepare a final estimate.

6. It is not believed that the cost of maintenance will exceed $5,000 per annum.

For the Board:

A. M. Miller,
*Lieut. Col., Corps of Engineers,*
*Senior Member Present.*

[Twelfth indorsement.]

War Department,
Office of the Chief of Engineers,
*Washington, December 9, 1903.*

Respectfully returned to Major Warren, requesting early return of this paper with the estimate referred to in paragraph 5 of the preceding indorsement.

By command of Brig. Gen. Gillespie.

W. V. Judson,
*Captain, Corps of Engineers.*

[Thirteenth indorsement.]

United States Engineer Office,
*Milwaukee, Wis., December 14, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, with the estimate inclosed as directed in the preceding indorsement.

J. G. Warren,
*Major, Corps of Engineers.*

[Fourteenth indorsement.]

War Department,
Office of the Chief of Engineers,
*Washington, December 21, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with final estimate as recommended.

By command of Brig. Gen. Gillespie.

H. F. Hodges,
*Major, Corps of Engineers.*

gradually built out into the channel, until at the present time the distance between piers at entrance is about 250 feet.

In May, 1873, a detailed survey of this harbor was made under the direction of Maj. D. C. Houston, Corps of Engineers, U. S. Army, and report submitted (see Report of Chief of Engineers, 1873, p. 254). The estimated cost of the proposed improvement was $290,000, and the conclusion derived from the survey was, "there are no facts tending to show that the general commerce of the country will be benefited by the improvement of this harbor."

No further action looking toward the improvement of this harbor by the United States was taken until November, 1879, when an examination was made under the direction of Maj. Henry M. Robert, Corps of Engineers, U. S. Army, and report submitted under date of December 20, 1879 (see Report of Chief of Engineers, 1880, p. 1931), in which a small amount of dredging was recommended to be done by the United States.

The original project for the improvement of this harbor was adopted in 1880, and provided for dredging a channel between the piers built by the Chicago Lumbering Company, the channel to be 150 feet wide and 13 feet deep below the present datum plane, which is 581.28 feet above mean tide at New York City; the estimated cost of this improvement was $6,000. For the purpose of carrying out this project, appropriations were made as follows:

| Act of— | |
|---|---|
| June 14, 1880 | $5,000 |
| March 3, 1881 | 1,000 |
| Total | 6,000 |

No other appropriations have ever been made for the improvement of this harbor by the United States.

In October, 1880, a survey of the harbor showed that the direction of the piers lay across the natural channel, and directly toward a reef having only about 10 feet of water over it. The Chicago Lumbering Company, which had the contract for dredging, found it necessary at this time to rebuild about 350 feet of the west pier, which had been washed away.

The officer in charge, Maj. Henry M. Robert, Corps of Engineers, U. S. Army, strongly advised the Chicago Lumbering Company to change the direction of the piers so as to conform with the natural channel, and stated at the same time that unless the direction of the piers was changed he should recommend that there be no further expenditures by the United States for the improvement of the harbor. The company declined to build the piers as recommended and their dredging contract was canceled.

Since then there has been no dredging done at this harbor by the United States, and the harbor was dropped from the list of duties of the officer in charge of this district, by authority of the Chief of Engineers, in letter dated January 2, 1896, and final report made in monthly report for February, 1896, at which time there was an unexpended balance of $2,044.95.

The correspondence relating to the change in direction of the piers, and subsequent annulment of contract and suspension of work by the United States, is published in Report of Chief of Engineers, 1881, page 2055, et seq., and 1882, page 2118.

Since the reports of 1873 and 1879, and the suspension of operations by the United States, there have been developments that have greatly increased the commercial importance of this harbor. While the Chicago Lumbering Company and associated companies continue to be the largest shippers, other important industries have been located at Manistique, among which are the Manistique Iron Company, having at the present time an output of about 40,000 tons per annum; the Burrell Chemical Company, and the White Marble Lime Company.

In addition to these industries, and of far more importance to the general commerce of the country, is the establishment of a car-ferry line between Manistique and Frankfort, Mich., by the Ann Arbor Railroad Company, which forms a new transportation line between the east and west. It is also reported that within a short time another car-ferry line will be opened. Under date of September 11, 1903, Mr. Richard R. Metheany, president of the Manistique, Marquette and Northern Railroad Company, writes as follows:

> This company will within two weeks put on a large car ferryboat to operate between Manistique and Northport, Mich., and it is expected that we shall make at least one round trip between these ports every day in the year.
>
> The boat is about 400 feet long over all and draws under full cargo of cars about 14 feet forward and 15½ aft.

In addition to these car-ferry lines, the Goodrich Transportation Company and the Hart Line maintain regular lines of steamers, calling in at Manistique during the season of navigation, steamers of the first-named line calling weekly and those of the other line three or four times each week.

The harbor of Manistique is seldom or never icebound to such an extent as to prevent the operation of car ferries. The Ann Arbor Railroad Company have operated their ferry to Manistique for several winters without serious trouble from ice, and it is the only harbor to which their ferry lines extend, north of Kewaunee, Wis., that is open during the entire year. The only complaints made are of insufficient depth of channel.

Manistique is the southern terminus of the Manistique, Marquette and Northern Railroad, which extends northward, connecting with the Duluth, South Shore and Atlantic Railway at Shingleton, Mich. It is also a station on the Minneapolis, St. Paul and Sault Ste. Marie Railway, and is thereby in direct rail communication with St. Paul, Minneapolis, and the Northwest.

The commercial statistics for Manistique for the calendar year ending December 31, 1902, as furnished by Mr. E. W. Miller, deputy collector of customs, are as follows:

*Arrivals and departures of vessels.*

| | Entered. | Cleared. |
|---|---|---|
| Steam | 184 | 185 |
| Sail | 138 | 138 |
| Total | 322 | 323 |

*Principal exports.*

| | | |
|---|---|---|
| Lumber | feet B. M. | 75,910,000 |
| Lath, pickets, and shingles | pieces | 14,066,000 |
| Pig iron | tons | 3,380 |
| Cars of freight | | 2,718 |

*Principal imports.*

| | | |
|---|---|---|
| Coal | tons.. | 1,950 |
| Cars of freight | | 2,303 |

The foregoing statistics are necessarily incomplete, for the reason that vessels clearing from and to other ports and calling in at Manistique are not required to report at the custom-house.

It will be noted from the foregoing statistics that the principal exports are lumber and other forest products and freight cars transported by the car ferries, and that the only imports of importance are cars of freight. Lumber and other forest products are usually carried in vessels of comparatively light draft; furthermore, the supply of standing timber tributary to Manistique is rapidly being reduced. The exports of lumber are becoming less each year, and it will be only a matter of a few years until they become unimportant.

But the ferrying of entire freight trains across the lake without breaking bulk is rapidly increasing in importance and will probably continue to increase with the building up of the Northwest, with which, as before stated, Manistique is in direct rail communication. It is not probable that there will be a very material increase in the local commerce of Manistique in the near future; but the general commerce passing through Manistique will probably become of more importance each year.

The harbor of Manistique has been treated by the Chicago Lumbering Company as private property, all the improvements, with the exception of the small amount of dredging done by the United States, having been made by them. In a letter to the Chief of Engineers, dated July 26, 1881 (see Report of Chief of Engineers, 1882, p. 2118), Maj. Henry M. Robert, Corps of Engineers, U. S. Army, says:

> The discussion arising out of the break in the pier caused by the storm in October, 1880, in my opinion shows that the company desires to retain this as a close harbor and will do nothing which will give the public any further right therein.

In view of this, the following letter was sent to the Chicago Lumbering Company:

MILWAUKEE, WIS., *September 9, 1903.*

DEAR SIRS: I am preparing a report on Manistique Harbor, Michigan, and desire therein to set forth all available information regarding the present and prospective commerce of this harbor. I shall therefore be pleased to receive from you at your early convenience such information relating to this subject as you can give.

It is understood that the slips which form the interior harbor of Manistique belong to you. It is desired to know whether any or all of them would be available for purposes of general commerce, and if so, when they would be available and for what draft of vessels.

Very respectfully,

J. G. WARREN,
*Major, Corps of Engineers.*

CHICAGO LUMBERING COMPANY,
*Manistique, Mich.*

No reply has been received to this letter, and it is not known whether or not the slips mentioned, and which are shown on map accompanying this report, would be available for purposes of general commerce.

As stated before, it is expected that within a short time another large car-ferry steamer will be calling in at Manistique, the maximum draft of this steamer being 15½ feet. This will probably be the maximum draft required for some years to come. But as the car ferries have been and probably will continue to be operated during the winter season, when the water is often from 2 to 2½ feet below datum, the depth in the entrance channel, to safely permit the car-ferry steamers to enter at any time, should be not less than 19 feet below datum. The act authorizing the survey specifies no definite depth to be obtained. In the estimate which follows a depth of 19 feet below datum plane, said plane being 581.28 feet above mean tide at New York City, is assumed as the depth to be obtained.

The survey developed the fact that solid rock underlies the outer harbor at variable depths, in some places being bare and in other places being covered with sand, sawdust, and clay. Numerous borings were taken where other materials overlie the rock, and the general surface of the rock obtained with sufficient accuracy to determine the location of the most economical and practicable channel.

On the map accompanying this report are shown the boundary lines of the proposed channel and the location of the piers necessary to protect the channel. The general location and direction of the proposed piers conform very closely to what was proposed by Maj. Henry M. Robert, Corps of Engineers, U. S. Army. (See map facing p. 2054, Report of Chief of Engineers, 1881.) The channel between these piers is practically the same as the one now used, and it can be deepened to 19 feet below datum without encountering solid rock.

The breakwater shown on map, about opposite the present harbor entrance, was built about seventeen years ago by the Chicago Lumbering Company, and consists of fourteen cribs each 26 feet wide and 30 feet long, filled with stone and decked. The superstructure, which extends to a height of about 8 feet above datum, is in fair condition, but will have to be renewed in the near future. It is then proposed to rebuild it with concrete. It is proposed to utilize this breakwater by connecting it with the end of the existing east pier, and also with the proposed new east pier, thus forming a basin, which would tend to still the water during storms, and also afford a turning basin.

The pier extensions are to consist of timber cribs, 20 and 24 feet wide, and provided with permanent concrete superstructures. The distance between piers at the outer end is to be 300 feet. Owing to the rock bottom, it will be impossible to drive foundation piles. The cribs are therefore to be placed on a foundation of stone, a trench being dredged to the solid rock before building this foundation. The east pier is to extend about 200 feet beyond the west pier, so as to protect the entrance from seas from a southeasterly direction. The west pier is to extend to the 19-foot contour. It will be necessary to remove about 650 feet from the outer end of the present west pier, and also to excavate a portion of the land belonging to the Manistique, Marquette and Northern Railroad Company and other parties, as is indicated on the map. The land required should be transferred to the United States without expense before the proposed improvement is commenced. The Chicago Lumbering Company should also release all claim it may have to the breakwater, in favor of the United States.

The proposed channel is to be 200 feet wide and 19 feet deep, and the basin is to be dredged to the same depth, so far as may be possible without encountering solid rock. The depth of 19 feet is to be carried between the present piers for a distance of 1,000 to 1,200 feet from their outer ends, at which distance solid rock is encountered at a depth less than 19 feet. The plan of improvement herewith submitted does not contemplate any rock removal. But the piers are to be so built that, should it become necessary or desirable in the future to increase the depth to 21 feet, the additional depth can be obtained without having to rebuild them.

The material to be dredged is believed to be mostly sand mixed with sawdust. For many years it was the practice of the Chicago Lumbering Company to discharge the sawdust from their mills directly into the river. Much shoaling was caused thereby, as well as a rapid advance of the shore line. This practice, which was the subject of a correspondence between Maj. Henry M. Robert, Corps of Engineers, U. S. Army, and the officers of the company (see Report of Chief of Engineers, 1881, p. 2056), has now been discontinued, and at the present time the sawdust with other mill refuse is disposed of by burning.

The following is an estimate of the cost of obtaining a channel 19 feet deep below aforesaid-established datum plane, and is based upon existing prices of materials and labor. Concrete superstructures, extending from a plane 3 feet below datum to a plane 5 feet above datum, are provided for in all cases.

| | | |
|---|---|---|
| 600 linear feet pier, 16 by 23 feet, at $50 | $30,000 | |
| 400 linear feet pier, 20 by 22½ feet, at $81 | 32,400 | |
| 1,300 linear feet pier, 24 by 22½ feet, at $92 | 119,600 | |
| 22,550 tons stone, foundation and riprap, at $1 | 22,550 | |
| Total for west pier | | $204,550 |
| 300 linear feet pier, 20 by 14½ feet, at $62 | 18,600 | |
| 200 linear feet pier, 20 by 16½ feet, at $66 | 13,200 | |
| 200 linear feet pier, 20 by 20½ feet, at $75 | 15,000 | |
| 100 linear feet pier, 24 by 15½ feet, at $70 | 7,000 | |
| 250 linear feet pier, 24 by 17½ feet, at $76 | 19,000 | |
| 300 linear feet pier, 24 by 18½ feet, at $81 | 24,300 | |
| 200 linear feet pier, 24 by 22½ feet, at $92 | 18,400 | |
| 400 linear feet pier, 24 by 24½ feet, at $98 | 39,200 | |
| 15,550 tons stone, foundation and riprap, at $1 | 15,550 | |
| Total for east pier | | 170,250 |
| 420 linear feet concrete superstructure on breakwater, at $65 | | 27,300 |
| Removing 500 linear feet old west pier, at $12 | | 6,000 |
| 260,000 cubic yards dredging, at 15 cents | | 39,000 |
| Contingencies, superintendence, etc | | 44,900 |
| Total | | 492,000 |

Should it become necessary to increase the depth to 21 feet below datum, each pier should be extended 200 feet, as shown on map by broken red lines, and the foregoing estimate would be increased by the following:

| | | |
|---|---|---|
| 200 linear feet pier, 24 by 22½ feet, at $92 | $18,400 | |
| 2,100 tons stone, foundation and riprap, at $1 | 2,100 | |
| Total for west pier | | $20,500 |
| 200 linear feet pier, 24 by 24½ feet, at $98 | 19,600 | |
| 1,900 tons stone, foundation and riprap, at $1 | 1,900 | |
| Total for east pier | | 21,500 |
| 90,000 cubic yards dredging, at 15 cents | | 13,500 |
| 11,000 cubic yards rock excavation, at $5 | | 55,000 |
| Contingencies, superintendence, etc | | 11,500 |
| Total | | 122,000 |

The total cost of obtaining a 21-foot harbor would then be $614,000. This does not include a depth of 21 feet in the basin, to obtain which it would be necessary to remove about 22,500 cubic yards of rock, additional, at an estimated cost, including contingencies, of $123,750.

It is believed that the proposed depth of 19 feet is all that will be required at Manistique for many years to come, and subject to the conditions hereinbefore stated, that the necessary land shall be donated to the United States, and that all claims which the Chicago Lumbering Company may have to the breakwater shall be relinquished, the harbor of Manistique is considered worthy of improvement by the United States in the manner proposed.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., September 29, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the views and recommendations of Major Warren.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

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## SUPPLEMENTARY REPORT ON SURVEY.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., November 20, 1903.*

GENERAL: In compliance with request contained in eighth indorsement, Office Chief of Engineers, November 16, 1903, I have the honor to submit the following estimate of the cost of modified project proposed by the Board of Engineers for Rivers and Harbors for the improvement of Manistique Harbor, Michigan, together with a blueprint[a] showing in red the proposed modified project.

To prepare a new tracing would require the services of a draftsman for about ten days, at an estimated cost of $40, and for which there is no money available. A blueprint of the original tracing accompanying the report of district officer dated September 24, 1903, is therefore submitted herewith, as the proposed modified project can be clearly shown thereon.

| | |
|---|---|
| 300 linear feet pier, 20 by 14½ feet, at $67.50 | $20,250 |
| 200 linear feet pier, 20 by 16½ feet, at $71.50 | 14,300 |
| 200 linear feet pier, 20 by 20½ feet, at $81 | 16,200 |
| Stone foundation and riprap for above, 7,000 tons, at $1 | 7,000 |
| Total for 700 linear feet pier, connecting end of east pier with easterly end of breakwater | 57,750 |
| 100 linear feet pier, 24 by 15½ feet, at $78 | 7,800 |
| 250 linear feet pier, 24 by 17½ feet, at $84.50 | 21,125 |
| Stone foundation and riprap for above, 2,255 tons, at $1 | 2,255 |
| Total for 350 linear feet pier, in extension of present breakwater to point marked "A" on tracing | 31,180 |

---

[a] Not printed.

The total estimated cost of extending the breakwater, by pier 24 by 17½ feet, is $90.92 per linear foot.

The foregoing estimates for piers provide for timber-crib substructures resting on stone foundations, and having concrete superstructures, all as described in report of September 24, 1903.

The estimated cost per linear foot of pier construction is higher than in the estimate submitted in report of September 24, 1903, for the reason that it is believed the contract unit prices would be from 5 to 10 per cent higher for doing the less quantity of work, the original estimate having been made on the assumption that a contract would be let for the entire work as therein specified.

*Estimate of cost of modified project.*

| | |
|---|---|
| 700 linear feet pier, connecting end of east pier with easterly end of breakwater | $57,750 |
| 350 linear feet pier, in extension of breakwater to point marked "A" on map of harbor | 31,180 |
| 420 linear feet of concrete superstructure on present breakwater, at $65 per linear foot | 27,300 |
| 150,000 cubic yards dredging to a depth of 19 feet below datum, within limits shown by broken red lines on blueprint herewith, at 15 cents | 22,500 |
| Contingencies, superintendence, etc | 13,270 |
| Total | 152,000 |

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

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## ADDITIONAL SUPPLEMENTARY REPORT ON SURVEY.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., December 14, 1903.*

GENERAL: In compliance with request contained in twelfth indorsement, Office Chief of Engineers, December 9, 1903, I have the honor to submit the following estimate of modified project proposed by the Board of Engineers for Rivers and Harbors, for the improvement of Manistique Harbor, Michigan:

| | |
|---|---|
| 300 linear feet pier, 20 by 14½ feet, at $67.50 | $20,250 |
| 200 linear feet pier, 20 by 16½ feet, at $71.50 | 14,300 |
| 200 linear feet pier, 20 by 20½ feet, at $81 | 16,200 |
| 7,000 tons of stone for foundation and riprap for above, at $1 | 7,000 |
| Total for 700 linear feet pier, connecting end of east pier with easterly end of breakwater | 57,750 |
| 100 linear feet pier, 24 by 15½ feet, at $78 | 7,800 |
| 250 linear feet pier, 24 by 17½ feet, at $84.50 | 21,125 |
| 2,255 tons of stone for foundation and riprap for above, at $1 | 2,255 |
| Total for 350 linear feet pier, in extension of present breakwater to point marked "A" on map of survey | 31,180 |
| 600 linear feet pier, 20 by 22½ feet, at $85 | 51,000 |
| 7,250 tons of stone for foundation and riprap for above, at $1 | 7,250 |
| Total for 600 linear feet of west pier, from present shore line to 17-foot contour | 58,250 |

The foregoing estimates for piers provide for timber-crib substructures resting on stone foundations and having concrete superstructures, all as described in report of September 24, 1903.

The estimated cost per linear foot of pier construction, which is higher than in the estimate submitted in report of September 24, 1903, is taken at the same figures as stated in report of November 20, 1903, and for the reasons therein set forth.

*Estimate of cost of modified project.*

| | |
|---|---|
| 700 linear feet pier connecting end of east pier with easterly end of breakwater | $57,750 |
| 420 linear feet of concrete superstructure on present breakwater, at $65 per linear foot | 27,300 |
| 350 linear feet pier, in extension of breakwater to point marked "A" on map of harbor | 31,180 |
| 600 linear feet pier, on west side of harbor, from present shore line to 17-foot contour | 58,250 |
| 160,000 cubic yards dredging to a depth of 19 feet below datum, over area lying outside of present 17-foot contour on west side of harbor, and dredging trench to rock for west pier, at 15 cents | 24,000 |
| Contingencies, superintendence, etc | 19,520 |
| Total | 218,000 |

The foregoing estimate is in accordance with the project laid down by the Board of Engineers for Rivers and Harbors, as per eleventh indorsement, December 5, 1903.

Attention is respectfully invited to the fact, probably unknown to the Board of Engineers for Rivers and Harbors, that under this project the west pier is not anchored at the inshore end, but begins directly at a beach which is known to be of very unstable and shifting material. During the progress of the survey the beach to the westward of the present harbor entrance was cut back at least 75 feet. The dotted line shown on map, about 150 feet back from the shore line, represents the line of what may be called fairly permanent beach. All that portion of the beach between the shore line and dotted line is composed of sawdust mixed with sand, and comes and goes with every storm.

It is therefore believed that if the west pier should be built from the shore line outward the first storm would leave it a detached work, by washing away the beach to the northward of it, and its purpose, at least to a considerable extent, would be defeated.

In view of the foregoing and for the information of the Chief of Engineers, I have prepared a second estimate, providing that the construction of west pier begin at the point originally proposed, as thereby it would be securely anchored to the existing west pier and be extended thence to 17-foot contour. If this were done, it would be necessary to dredge a trench to rock along the line of this pier through the beach, and the estimate provides for the dredging specified in report of September 24, 1903, except for dredging trench for west pier beyond the 17-foot contour.

The estimated cost of the west pier would be as follows:

| | |
|---|---|
| 600 linear feet pier, 16 by 23 feet, at $53 | $31,800 |
| 600 linear feet pier, 20 by 22½ feet, at $85 | 51,000 |
| 12,000 tons stone for foundation and riprap for above, at $1 | 12,000 |
| Total for 1,200 linear feet of west pier | 94,800 |

The total estimate will then be as follows:

| | |
|---|---|
| East pier and breakwater as before | $116,230 |
| 1,200 linear feet west pier | 94,800 |
| 230,000 cubic yards dredging, at 15 cents | 34,500 |
| Contingencies, superintendence, etc | 24,470 |
| Total | 270,000 |

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

### J J 21.

### PRELIMINARY EXAMINATION AND SURVEY OF MENOMINEE, MILWAUKEE, AND KINNICKINNICK RIVERS, MILWAUKEE HARBOR, WISCONSIN.

[Printed in House Doc. No. 120, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith reports dated July 19, 1902, and August 31, 1903, with map,[a] by Maj. J. G. Warren, Corps of Engineers, on preliminary examination and survey, respectively, of "the Menominee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee, with a view to the improvement and enlargement of the harbor facilities at Milwaukee by the deepening of said rivers and the construction of one or more turning basins or otherwise," made pursuant to a requirement in the river and harbor act of June 13, 1902.

The work contemplated involves the improvement of streams which constitute the inner harbor at Milwaukee, where an exterior harbor of refuge and an entrance channel have heretofore been constructed by means of a breakwater and parallel jetties to the entrance to the inner harbor, a large portion of the cost of the latter having been borne by the city.

It is the opinion of Major Warren that the present and prospective commerce will justify the improvement by the United States, and this opinion is concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers, and by the Board of Engineers for Rivers and Harbors, which has examined and reviewed these reports in pursuance of the provisions of sections 3 and 14 of the above-mentioned act. Major Warren presents a project for improvement under certain stipulated conditions. A résumé of this project and conditions is made by the Board of Engineers in its report of October 2, 1903, in which the Board concludes "that it is desirable for the United States to undertake the improvement of the Menominee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee, in the manner proposed by the district officer, and subject to the conditions mentioned," at a cost of $318,581.

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[a] Not reprinted; printed in House Document No. 120, 58th Congress, second session.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### PRELIMINARY EXAMINATION OF MENOMINEE, MILWAUKEE, AND KINNICKINNICK RIVERS, MILWAUKEE HARBOR, WISCONSIN.

United States Engineer Office,
*Milwaukee, Wis., July 19, 1902.*

General: I have the honor to submit the following report upon a preliminary examination made at Milwaukee, Wis., in accordance with instructions contained in letter from Office of the Chief of Engineers, United States Army, dated June 23, 1902, and to comply with requirements of an item in section 14 of act approved June 13, 1902, which reads as follows:

> Milwaukee: The Menominee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee, with a view to the improvement and enlargement of the harbor facilities at Milwaukee by the deepening of said rivers and the construction of one or more turning basins or otherwise. In any estimate, the cost of land required, if any, shall not be included.

2. A report on preliminary examination of Milwaukee Harbor, Wisconsin, with a view to necessary enlargement and suitable protection therefor, was submitted on August 6, 1900, and published in House Document No. 86, Fifty-sixth Congress, second session.

3. A description of the present harbor and a summary of the history of the improvement were given in that report, to which attention is respectfully invited.

4. The report of August 6, 1900, dealt primarily with the proposition for an outer harbor, and, while adverse to that proposition, stated that—

> When, however, the present interior facilities shall have been fully utilized, should it be then demonstrated that turning basins were necessary, the construction of such turning basins might properly be undertaken by the United States in the interests of general commerce.

5. Nearly 6,000 vessels of all classes, including the largest vessels on the Great Lakes, arrive at Milwaukee annually, and as the rivers are narrow and in places very crooked, it is very difficult to turn the larger vessels, commerce being thereby impeded. At places the rivers are so narrow that vessels lying at docks on opposite sides of the river nearly obstruct the channel, making navigation both difficult and dangerous.

6. There have been no harbor lines established by the United States, and the encroachments of property owners upon the already narrow channels are annually making them more and more restricted, to their

consequent impairment for purposes of general commerce. It is evident from the constant encroachments of property owners upon the navigable channels that if the interior harbor of Milwaukee is to remain sufficient to accommodate the general commerce of the port, harbor lines should be established by the United States, in accordance with section 11, river and harbor act of March 3, 1899.

7. There has been no survey of the rivers forming the interior harbor of Milwaukee made by the United States, and such maps as exist are either so inaccurate or so fragmentary as to be useless, if not misleading, for the purpose of laying down harbor lines. In order to intelligently establish harbor lines, a complete survey will have to be made and a map, or maps, prepared.

8. Accurate maps are also desirable in order that an intelligent study of the entire situation can be made, and the location of turning basins determined, should their construction prove advisable.

9. Milwaukee is the second harbor in commercial importance on Lake Michigan, and its commerce, which has now reached large proportions, is constantly growing. Recent statistics published by the Bureau of Statistics of the Treasury Department place Milwaukee first among the lake ports in coal receipts, the total receipts of coal of all kinds, by way of the harbor only, for the calendar year ending December 31, 1901, being 1,827,476 tons, an amount exceeded only by the combined receipts of Duluth, Minn., and Superior, Wis.

10. A large proportion of the work of improvement of the harbor has been done by the city of Milwaukee, the amounts expended by the United States and by the city on the harbor, not including the harbor of refuge, being as follows:

| | |
|---|---|
| Expended by the United States | $443,374.62 |
| Expended by the city of Milwaukee | 445,971.20 |

These amounts apply to the harbor entrance only, i. e., from Lake Michigan to the Milwaukee River. The amounts expended in dredging and otherwise improving the rivers or interior harbor are not included, and no part of that work has been done by the United States. It is evident from the foregoing figures that the relative amounts expended by the United States and the city of Milwaukee in the improvement of the harbor are altogether disproportionate when compared with other harbors in this district and elsewhere.

11. The city is replacing its old swing bridges spanning the rivers with bascule bridges as rapidly as practicable, thereby clearing the channel of center piers and improving navigation.

12. In view, therefore, of the large amount of commerce involved and of the public spirit evinced by the city of Milwaukee in contributing so largely to the improvement of the harbor, it would seem that its further improvement by the United States was merited to such an extent as may be consistent with public policy.

13. I am of the opinion that present and prospective commerce will justify the proposed improvement by the United States.

14. It is therefore recommended that a complete survey of the Menominee, Milwaukee, and Kinnickinnick rivers, so far as they form the interior harbor of Milwaukee, be made, and maps prepared on which can be laid down the proposed harbor lines and turning basins, and that the necessary harbor lines be established.

15. The estimated cost of making the survey and preparing maps, etc., is $2,000.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., July 21, 1902.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion expressed in the thirteenth paragraph, with the understanding that the right of way is to be furnished free of charge to the United States, as intimated in the law, and with the further understanding that the depths to be obtained shall be maintainhd by the city so long at least as sewage is discharged into the harbor.

I concur in the recommendations contained in fourteenth and fifteenth paragraphs.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 12, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 20, 1902.*

Respectfully returned to the Chief of Engineers.

The Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, under provisions of section 3 of the river and harbor act approved June 13, 1902, has considered the within report of Major Warren on the preliminary examination of Menominee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee, Wis.

In the opinion of the Board the commerce involved is so large as to warrant a further improvement of the locality in the interests of navigation, provided a complete survey shall indicate that such improvement can be made at a reasonable cost.

The Board therefore recommends that a survey be authorized with a view to determining the character, quantity, and approximate cost of the work necessary, and that the sum of $2,000 be allotted for this purpose.

A. MACKENZIE,
*Colonel, Corps of Engineers,*
*Senior Member of Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 21, 1902.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Menominee, Milwaukee, and Kinnickinnick rivers, at Milwaukee, Wis., authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in preceding indorsement, I recommend that a survey of the locality be made as proposed.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Fifth indorsement.]

WAR DEPARTMENT,
*August 25, 1902.*

Approved as recommended by the Acting Chief of Engineers.

WM. CARY SANGER,
*Acting Secretary of War.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 14, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 2, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the accompanying report of the district officer, dated August 31, 1903, on a survey of the "Menomineee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee," the indorsement of the division engineer thereon, and other data available. On June 24, 1903, a committee of the Board visited the locality and discussed the contemplated improvement with the district officer.

The project proposed by the district officer is to excavate four turning basins, one in the Menominee River and three in the Kinnickinnick; to excavate a channel 100 feet wide from the turning basin in the Menominee to the mouth of that river, and 150 feet wide therefrom to the harbor entrance; and a channel from 100 to 150 feet wide from the mouth of the Kinnickinnick to the uppermost turning basin in that river. All channels to be 21 feet deep.

He proposes that the United States shall not do any work of maintenance upon these rivers after the basins and channels have been provided, nor upon the Milwaukee River, but that all work of maintenance be left to local interests. He recommends also that the work of improvement shall be conditional upon the donation to the United States, free of cost, of all land needed for turning basins and for widening and straightening the rivers; upon the revetment or docking by the city of Milwaukee of all turning basins and connecting channels wherever necessary; and upon the alteration or rebuilding of the city bridge across the Kinnickinnick and the two railway bridges immediately above in such wise as to permit the passage of the largest vessels. The estimated cost of the work proposed by the district officer is $318,581.

The extent and character of the commerce of this port is described in the district officer's report. The Board believes that in comparison with the benefits to navigation that may be expected to result the estimated cost of the work is reasonable. The Board likewise indorses the conditions which the district officer couples with his recommendation, but believes that the condition as to the revetment of basins and channels should be expanded to include an assumption by the city of Milwaukee of all liability for damages to riparian property that may result from the prosecution of the proposed work.

A noticeable feature of this case is that it is here proposed to take up and extend a work which up to this time has been carried on by local interests in an interior lake harbor. The lower portions of the rivers Milwaukee, Menominee, and Kinnickinnick constitute the commercial harbor of Milwaukee. While the improvement of the interior waters of a small port, the business of which was to a considerable extent local—that is, without material influence upon the general commerce of the country—might be of questionable propriety, the Board believes that the commercial importance of Milwaukee, and its location with respect to main arteries of trade, render the proposed improvement, at the estimated cost, a matter of public utility and profit. Any particular benefit that may inure to the local community in excess of that which extends to the general public will be offset by the maintenance of the completed channels by local interests at their own expense. The fact that sewage, both house and storm, is discharged into these rivers is an additional reason why the United States should be put to no expense for maintaining the channels and basins after they have been provided at public expense.

The Board is accordingly of opinion that it is desirable for the United States to undertake the improvement of the "Menominee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee," in the manner proposed by the district officer, and subject to the conditions mentioned herein, at a cost of $318,581.

For the Board:

Chas. J. Allen,<br>
*Lieut. Col., Corps of Engineers,*<br>
*Senior Member of the Board.*

## SURVEY OF MENOMINEE, MILWAUKEE, AND KINNICKINNICK RIVERS, MILWAUKEE HARBOR, WISCONSIN.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., August 31, 1903.*

GENERAL: I have honor to submit the following report of a survey and estimate of cost of the improvement of Milwaukee Harbor, Wisconsin, in accordance with the requirements of an item in section 14, river and harbor act approved June 13, 1902, which reads as follows:

> Milwaukee: The Menominee, Milwaukee, and Kinnickinnick rivers, in the city of Milwaukee, with a view to the improvement and enlargement of the harbor facilities at Milwaukee by the deepening of said rivers and the construction of one or more turning basins or otherwise. In any estimate, the cost of land required, if any, shall not be included.

2. The harbor of Milwaukee is situated on the western shore of Lake Michigan, about 100 miles north from the head of the lake. The present harbor entrance is an artificial channel located about 3,000 feet north of the original mouth of the Milwaukee River. Two small streams, known as the Menominee and Kinnickinnick rivers, empty into the Milwaukee River a short distance from the harbor entrance. The three rivers mentioned constitute the interior or commercial harbor of Milwaukee. The harbor of refuge, located immediately north of the harbor entrance, is formed by partially inclosing a portion of Milwaukee Bay by a breakwater 7,250 feet long, which provides a safe anchorage ground of about 296 acres, outside of the 18-foot contour. The relative location and size of the rivers, together with the location of old river mouth, present harbor entrance, and harbor of refuge, are shown on the map accompanying this report.

3. The earliest survey of this harbor, with a view to its improvement by the United States, was made by Lieutenants Center and Rose in 1836. The map of the survey, proposed plan of improvement, and report on same were published in Senate Document No. 175, Twenty-fifth Congress, second session. The plan therein proposed was almost identical with the one subsequently adopted, and provided for an artificial entrance to the Milwaukee River at about the location of the present harbor entrance.

4. Nothing further was done by the United States looking toward the improvement of this harbor until 1843, when Congress appropriated $30,000, and the following year, 1844, $20,000, a total of $50,000, which was expended in an attempt to improve the original river mouth by constructing piers and dredging a channel between them to a depth of 10 feet.

5. In 1852 Congress appropriated $15,000 to be expended on the plan of improvement proposed in 1836. This sum was totally inadequate, and the city of Milwaukee raised by taxation the sum of $50,000, to be expended for the same purpose. Work on the present entrance, formerly known as the "straight cut," was commenced in 1855, but no further appropriation was made by the United States until 1866.

6. Between 1855 and 1867 the city of Milwaukee constructed two crib piers, each 1,120 feet long, and dredged a channel between them to a depth of 12 feet. All the expenses of this work were defrayed by the city of Milwaukee, except $15,000 appropriated by the United States, as before stated. The total amount expended by the city of Milwaukee on the improvement of the harbor entrance is $445,971.20.

7. Since 1867 the improvement has been carried on entirely by the United States, and up to the present time $1,618,124.67 has been appropriated for the improvements made by the General Government at Milwaukee, distributed as follows:

| | |
|---|---|
| Survey of 1836 | $400.00 |
| Improving old mouth of Milwaukee River | 50,000.00 |
| Improving present harbor entrance | 461,925.36 |
| Harbor of refuge | 1,105,799.31 |
| Total | 1,618,124.67 |

8. The present project of improvement provides for the maintenance of a depth of 21 feet below datum, said datum being 581.28 feet above mean tide at New York City. The improvement carried on by the United States terminates at the shore end of the piers, no work having been done on the interior harbor by the General Government. The city of Milwaukee maintains a depth of from 14 to 21 feet in the rivers.

9. To comply with the provisions of the act quoted above, a careful survey of the rivers has been made, and the results have been plotted to a scale of 1 inch to 100 feet, on 11 large sheets. The map accompanying this report is a pantographic reduction of the large scale maps, with the addition of the results of a survey of the harbor of refuge, made in 1901.

10. Especial care has been taken both in making the survey and in plotting the notes to insure accuracy, as it is proposed to lay down on the large scale maps a system of harbor lines, which will be completed and submitted for approval as soon as the will of Congress in the matter of proposed improvement is known.

11. The locations of the proposed turning basins are shown on the map in red. It will be noted that no turning basin is shown on the Milwaukee River. This river is the largest of the three, having an average width of about 225 feet. A dam across the river about 3 miles from the harbor entrance marks the head of navigation, although actually no vessels go above the bridge at Racine street, immediately below the dam, which has no draw span. With the exception of the upper end of the river, both sides of it are docked. In many places, however, the docks are not available for commercial purposes, as large buildings are located close to the edge, the docks serving the purpose of revetments only and being of no use as wharves. Beyond maintaining a depth of 21 feet there is little or no opportunity of effecting any improvement of the Milwaukee River.

At the upper end of the river bluffs rise on each side close from the edge, making the construction of a turning basin in that portion of the river impracticable. Such land as could be converted into a turning basin is occupied by large and important manufacturing plants, and the cost of acquiring it would be so great as to be practically prohibitive.

12. The situation on the Menominee River, * * * with its tributary canals and slips, is but little better than on the Milwaukee River, and in some respects is even worse, it being narrower, with an average width of about 140 feet. Many important manufacturing plants are located along this river, including some of the largest coal yards in the city. The upper portion of the Menominee River, shown at bottom

of map, is practically the head of navigation. The river there makes a short bend, and is spanned by two railroad bridges belonging to the Chicago, Milwaukee and St. Paul Railway Company, which has likewise an extensive system of tracks and yards in that vicinity.

13. The site for the proposed turning basin on the Menominee River, shown on map, is believed to be the only practicable site on the river, the necessary land being at the present time unoccupied. The Milwaukee Gas Light Company has lately erected a large plant nearly opposite the site proposed, and some of the largest coal docks are located just below it. The proposed basin is to be 21 feet deep, 650 feet long, and about 500 feet wide; this is the greatest width that can be obtained without unwarranted cost, and while not sufficient to permit the largest vessels to turn, will accommodate fully 90 per cent of the vessels entering this harbor (550 feet is the present maximum length of vessels navigating the Great Lakes). Whenever practicable, however, a turning basin should have a least diameter of 650 feet, so that the largest vessel could be turned therein, and at the same time allow other vessels to be moored to the docks. In connection with the turning basin it is proposed to dredge a channel 21 feet deep and about 100 feet wide, from the basin to the mouth of the river, and from thence to the harbor entrance, the width to be 150 feet.

14. The city of Milwaukee is now building a bridge of the bascule type at Muskego avenue in place of the old center-pier draw, and a contract has been awarded for a new bascule bridge at West Water street. The Chicago, Milwaukee and St. Paul Railway Company is also about to rebuild its bridge immediately below the West Water Street Bridge, placing a new center pier on the south side of the river, thus providing a channel through the bridges in the center of the stream. The bridge at Sixteenth street is of the bascule type. The remaining bridges crossing the main river and its lateral canals are center-pier swing bridges, but it is expected that when it becomes necessary to rebuild them they will be replaced by bascule bridges.

15. The Kinnickinnick River offers better opportunities for improvement and development than either of the other two rivers. Its width is not so great as the Milwaukee River, being from 150 to 200 feet, but the adjoining land, which is low and easily excavated, is not as fully occupied as on either of the other rivers, and it is believed the value of same is less. The river is accessible by both the Chicago, Milwaukee and St. Paul Railway and the Chicago and North-Western Railway, and runs through the south part of the city, which is rapidly becoming the great manufacturing district. Its improvement, therefore, would be of great benefit to general commerce.

16. Three turning basins, each having a least diameter of 650 feet and a depth of 21 feet, are proposed to be located on the Kinnickinnick River, the basins to be located as shown on map and to be connected with the harbor entrance by a channel from 100 to 150 feet wide and 21 feet deep. Basin No. 1 is to be located at the mouth of the Kinnickinnick and at the lower end of the shallow lagoon shown on map. Basin No. 2 is at the sharp bend in the river immediately above Clinton Street Bridge, and Basin No. 3 is at the present head of navigation.

17. The three bridges (one highway and two railroad) crossing the river at a turn in same just below Basin No. 2 are at the present time a very serious obstruction to navigation. Before Basin No. 2 would be of any benefit to commerce it would be necessary to so improve the

river at that point that it might be navigable for the largest vessels. As shown on the map, it is proposed to widen the river at the bridges, thereby straightening the channel. The bridges would also have to be reconstructed, so as to afford a practicable center channel for the largest vessels. The present bridge at Clinton street has a clear width of opening on either side of 62 feet. While that is sufficient for the present needs of navigation, it is believed that the minimum clear opening for drawbridges in this locality should be 75 feet.

18. At the present time the sharpness of the turn just above Clinton Street Bridge prevents large vessels from reaching the upper part of the Kinnickinnick, even were the conditions just below improved as before mentioned. By locating Basin No. 2 at this place, therefore, not only is a turning basin provided, but the upper river is made available to large vessels.

19. The following is the estimate of cost of the proposed improvement as outlined above, and is simply for the necessary dredging:

| | | | |
|---|---|---|---|
| Menominee River: | Cubic yards. | | |
| Turning basin | 339,700 | | |
| Channel from mouth of river to basin | 56,000 | | |
| Total | 395,700 at 15 cents. | | $59,355 |
| Contingencies, superintendence, etc., 10 per cent | | | 5,935 |
| Total for Menominee River | | | 65,290 |
| Kinnickinnick River: | Cubic yards. | | |
| Turning Basin No. 1 | 299,700 | | |
| Channel from harbor entrance to basin | 47,700 | | |
| Total | 347,400 at 15 cents. | | 52,110 |
| Contingencies, superintendence, etc., 10 per cent | | | 5,211 |
| Total for Basin No. 1 | | | 57,321 |
| | Cubic yards. | | |
| Turning Basin No. 2 | 351,800 | | |
| Channel from Basin No. 1 to Basin No. 2, including widening of river | 128,800 | | |
| Total | 480,600 at 15 cents. | | 72,090 |
| Contingencies, superintendence, etc., 10 per cent | | | 7,209 |
| Total for Basin No. 2 | | | 79,299 |
| | Cubic yards. | | |
| Turning Basin No. 3 | 552,600 | | |
| Channel from Basin No. 2 to Basin No. 3 | 154,500 | | |
| Total | 707,100 at 15 cents. | | 106,065 |
| Contingencies, superintendence, etc., 10 per cent | | | 10,606 |
| Total for Basin No. 3 | | | 116,671 |
| Summary: | | | |
| Menominee River | | | 65,290 |
| Kinnickinnick River: | | | |
| Basin No. 1 | | $57,321 | |
| Basin No. 2 | | 79,299 | |
| Basin No. 3 | | 116,671 | |
| | | | 253,291 |
| Grand total | | | 318,581 |

20. The commerce of Milwaukee is large and steadily increasing. Milwaukee to-day stands first among the harbors on the Great Lakes in coal imports by vessel. For the calendar year ending December 31, 1902, the imports of coal by way of the harbor amounted to 1,489,970 tons, which was less than the average, owing to the coal famine that prevailed during the latter half of the year. For the calendar year ending December 31, 1901, the coal imports by way of the harbor amounted to 1,852,476 tons, and it is not unreasonable to anticipate that the imports for 1903 will exceed 2,000,000 tons. A large portion of the coal received by vessel is loaded on cars and shipped west.

21. Under date of August 6, 1900, a report on preliminary examination of Milwaukee Harbor, Wisconsin, with a view to necessary enlargement and suitable protection therefor, was submitted, and published in House Document No. 86, Fifty-sixth Congress, second session, to which attention is invited. The plan of improvement therein discussed was for an exterior harbor. The matter was referred to a committee from the Milwaukee Chamber of Commerce. The report of the committee, which was adverse to the proposition, is published in full in the above-mentioned document. While the report of August 6, 1900, was unfavorable to the plan for an exterior harbor, it was stated that "when, however, the present interior harbor facilities shall have been fully utilized, should it be then demonstrated that turning basins were necessary, the construction of such turning basins might properly be undertaken by the United States in the interests of general commerce."

22. The present available dockage is nearly all utilized, such as remains only partially used being so situated as to be practically inaccessible to the larger class of vessels. In confirmation of this it may be said that available dock frontage at the present time is held at from $100 per front foot upward, with an ever increasing tendency.

23. At the present time there are about 21.8 miles of dock frontage on the three rivers, distributed as follows:

| | Miles. |
|---|---|
| Milwaukee | 7.6 |
| Menominee | 8.7 |
| Kinnickinnick | 5.5 |
| Total | 21.8 |

24. These figures represent the actual available dock frontage, and are exclusive of ends of and entrances to slips as well as such portions of the frontage as are obstructed by bridges. Under present conditions, however, it is not all available for commercial purposes, on account of buildings close to edge of docks, as previously mentioned. Many of the docks are old and poor, and were constructed when the channel depth was but 12 to 16 feet.

25. Of the total frontage above mentioned, the following amounts are the frontages not provided with docks or revetments:

| | Miles. |
|---|---|
| Milwaukee | 0.9 |
| Menominee | .3 |
| Kinnickinnick | 2.4 |
| Total | 3.6 |

## PRELIMINARY EXAMIN

[Printed in House Doc. No.

OFFICE

SIR: I have the honor to submi
13, 1903, by Maj. J. G. Warren,
examination of harbor at Port W
and harbor act approved June 1

This harbor has heretofore be
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in 1869, and, as subsequently modified, provided for a small artificial harbor, consisting of two interior basins having a combined area of about 5¾ acres, and connected with Lake Michigan by a channel between parallel piers, about 150 feet apart, the depth in channel and basins to be 13 feet below the established datum plane, which is 3.06 feet below the plane of reference of United States Lake Survey, or high water of 1838, or 581.28 feet above mean tide at New York City. The present project was completed in 1896. Since then the expenditures at this harbor have been for maintenance. The total amount appropriated for the improvement of this harbor is $204,936.50.

The Sauk River, so called, is only a small creek which empties into Lake Michigan at Port Washington. This stream offers no advantages for the construction and development of an interior harbor. On the contrary, it has been necessary to prevent its discharge into the harbor basin, which was rapidly filling up with the silt brought down in time of freshets.

Bluffs from 50 to 100 feet high rise from the shore both north and south of the harbor, so that the area available for an artificial interior harbor is limited, and has been fully utilized in the construction of the present basins. The area of the harbor can only be increased by the construction of exterior works, thereby utilizing the lake front for harbor purposes. Such construction, it is my experience, can only be justified when a corresponding benefit to the general interests of commerce is reasonably certain.

The principal industry of Port Washington is the manufacture of chairs, carried on by one concern, which occupies nearly all the frontage on the north basin. Other industries of lesser importance are two foundries, a malting company, two brickyards, a furniture factory, and a tannery.

The present depth in the harbor is 13 feet below the aforesaid established datum plane. At the time of the adoption of the present project this depth was actual and ample for all needs of commerce on the Great Lakes. At the present time, however, owing to the great increase in the draft of vessels and the lowering of the level of Lake Michigan, only the smaller craft can enter the harbor, the actual depth being about 11 feet.

The present harbor could be increased in depth by dredging, but, owing to the limited and restricted area of the basins, there is no doubt that were the depth increased so as to permit vessels of deeper draft to enter, the harbor could be used only in calm weather. Experience has shown, in the case of other harbors on the west shore of Lake Michigan, that an increase in depth produces a corresponding increase in disturbance in the harbor as a result of storms.

At the present time and under existing conditions it is unsafe for any but small craft to enter the harbor of Port Washington or to remain there during heavy storms, the combined area of the two basins being insufficient to allow the inrushing water to spread out and thereby still itself; and, as has already been stated, the available area for interior basins is now fully utilized. If the depth were to be increased, it is believed that it would be unsafe for vessels to attempt to enter or to remain in the present harbor, except during calm weather, and that, so far as a "harbor" is concerned, it would be little better than the old "bridge piers" of thirty years ago, that extended directly from the shore into the lake. To make the harbor of Port Washington available for deeper draft vessels at all times, it would therefore be necessary to construct one or more breakwaters, thus forming a protected exterior harbor.

There are no regular lines of steamers calling at Port Washington. The Goodrich Transportation Company, which maintains a regular line of steamers for both freight and passengers on the west shore of Lake Michigan, never call at Port Washington. During the season of 1902 the Barry Transportation Company attempted to maintain a regular line of steamers calling at this harbor. The service was, however, very irregular.

The commerce of Port Washington is small and entirely local in its character. The principal imports by way of the harbor are coal and lumber for local consumption. The amount of coal thus imported does not exceed 9,000 tons per annum; the imports of lumber do not exceed 7,000,000 feet B. M. per annum. No coal is shipped from Port Washington into the interior of the State. The exports by way of the harbor are insignificant.

A claim has been put forward by persons interested in the improvement of this harbor that it "is often sought as a harbor of refuge by weather-bound vessels." It is not known that any vessels, except fishing vessels and similar small craft, seek Port Washington as a harbor of refuge. Such vessels are of light draft and can readily enter the present harbor, and, for reasons already stated, any deepening of the harbor would prove harmful rather than beneficial to them. In my opinion, therefore, and for reasons already stated, the claim for a harbor of refuge is not well taken.

On April 18, 1899, a report was made on a preliminary examination at Port Washington, and subsequently published in House Document No. 44, Fifty-sixth Congress, first session. As some of the people at Port Washington expressed dissatisfaction with that paper, every opportunity has, in the present case, been given to those interested to be heard and to present such facts and figures as might enable them to establish a claim for better harbor facilities.

As a result of several conferences with leading citizens, the petition[a] appended, marked "A," was received. As this was of a very general nature, and as nothing was furnished in support of the claims which it set forth, a set of questions was prepared and sent to the principal signers of the petition, with request for categorical answers. Those received are appended, marked "B,"[a] "C,"[a] "D."[a]

In view of all the information obtainable and of the facts as submitted herewith, I am of the opinion that the existing harbor facilities at Port Washington, Wis., are adequate to the present and prospective demands of commerce at that place and that no further improvement is necessary at this time; therefore no survey is recommended.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

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[a] Not printed.

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 16, 1903.*

Respectfully forwarded to the Chief of Engineers.

The local conditions at Port Washington being unfavorable to harbor improvement except at great cost, and the prospective trade of the port not being sufficient to justify a heavy expenditure, I concur in the opinion that no enlargement of the present project is desirable, and in the recommendation that no survey be made.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 5, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 11, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of "Harbor at Port Washington," Wis., the indorsement of the division engineer thereon, and all other data available. On June 24, 1903, a committee of the Board inspected the locality and held a public hearing, at which interested parties were given opportunity to express their views.

Port Washington is situated upon the west shore of Lake Michigan, about 25 miles north of Milwaukee, and about 27 miles south of Sheboygan. It is a manufacturing town, with a population in 1900 of 3,010. The only railroad passing through Port Washington is the Chicago and Northwestern, which here parallels the lake shore.

The harbor is artificial, consisting of two interior basins or slips, connected with the lake by a channel between parallel piers 150 feet apart. The present depth in basins and channel is 13 feet, measured from the established datum plane, or about 11½ feet measured from the present lake surface, and this is the depth required under the existing project.

The available wharf frontage upon the two basins is about 2,200 feet. Due to neighboring bluffs, this could not be increased, nor could the area of the basins, about 5¾ acres, at reasonable expense.

The absence of any interior transportation route other than the railroad above mentioned forbids expectation that products to or from interior points would seek Port Washington Harbor. The commerce, originating in the town or comprising articles destined for consumption or manufacture there, is all that would be affected by any improvement.

Local industries include a large chair factory, a furniture factory, 4 foundries, 1 flouring mill, 1 brewery, 1 tannery, and 2 brickyards, employing in all about 1,500 men.

About 7,000,000 feet B. M. of lumber is received annually at Port Washington, of which about one-half now comes by water. The local coal consumption is about 9,000 tons annually, and nearly all is received by water. The annual production of bricks is reported at 5,000,000, of which 3,000,000 are barged to Milwaukee.

There are no wholesale distributing houses at Port Washington, package freight received being for local consumption only.

It is estimated by interested parties that the total freights in and out aggregate about 70,000 tons, about one-third by water.

The wharf frontage and basin area are ample for all commerce, existing or prospective. Much of the interior harbor is exposed to wave action, and existing depths forbid the entrance of other than light-draft vessels. Due primarily to insufficient depths, no regular line of steamers now makes Port Washington a port of call.

It is possible that the saving due to decreased freight rates might exceed the expense of maintenance and the interest on the original cost of the improvements necessary to obtain and protect an interior harbor of suitably increased depth. Nevertheless, the harbor is too near Milwaukee to give promise of becoming a general distributing point or of developing any trade of other than local importance. There are many such harbors, the improvement of which would be of undoubted local benefit, but can not be undertaken for financial reasons until places of more general importance have been suitably provided for. For this reason the Board records its opinion that the further improvement at Port Washington by the General Government is not advisable at the present time.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## SURVEY OF HARBOR AT SOUTH MILWAUKEE, WIS.

[Printed in House Doc. No. 116, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a report dated April 10, 1903, by Maj. J. G. Warren, Corps of Engineers, on resurvey of harbor at South Milwaukee, Wis., with a view to a modification of the present plan of said harbor and the construction of a harbor suitable for the needs of commerce at said port, with plans and estimates of the same, ordered by the river and harbor act of June 13, 1902.

The present plan for the improvement of this locality contemplates the construction of parallel piers to provide a harbor entrance 200 feet wide, 18 feet deep, at an estimated cost of $138,000, and $5,000 was appropriated for the purpose by the river and harbor act of June 3, 1896.

Major Warren states that an inner harbor at the locality could be provided by improvement of Oak Creek with a channel varying from 250 feet at the entrance to a least width of 150 feet, with a turning basin of 300 feet in diameter at its upper end. In his opinion, however, such a channel would be of but little practical benefit, and it is neither feasible nor advisable to construct such an inner harbor.

Two other plans for improvement are presented, as follows:

A. For a detached breakwater so arranged as to inclose a basin accessible from the lake by two entrances, each 300 feet wide, the basin to be dredged to a depth of 21 feet below datum, all at an estimated cost of $620,000, exclusive of the cost of wharves and slips, which should be provided by private parties or the city of South Milwaukee at their own expense. Under this plan the present project is to be abandoned and Oak Creek diverted so as to flow into Lake Michigan to the north of the proposed harbor.

B. This plan necessitates certain modifications of the present project, and provides for the construction of a basin of about 10 acres area inclosed by a pile pier to the north of the present entrance. It involves removal of the inshore end of the north pier, extension of the south pier, diversion of Oak Creek so as to discharge south of the harbor, and dredging the basin and entrance channel to a depth of 18 feet below datum. The estimated cost of this plan is $236,000, and it does not include the cost of revetting the west side of the basin, which should be done by private parties. A depth of 21 feet below datum under this plan is estimated to cost $300,000.

For reasons given in his report, Major Warren expresses the belief that present and prospective commerce does not justify the construction of a harbor at this place, and his views are concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers.

This report has been reviewed by the Board of Engineers for Rivers and Harbors pursuant to the provisions of sections 3 and 14 of the last river and harbor act; the locality has been visited, and a public hearing has been held at which interested parties were given an opportunity to express their views. From the facts before it the Board concludes, in its report of July 17, 1903, that the benefit received from the construction of a harbor at South Milwaukee would not be commensurate with the cost, and that it is not advisable for the United States at this time to construct a harbor there.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

## REPORT OF MAJ. J. G. WARREN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Milwaukee, Wis., April 10, 1903.*

GENERAL: I have the honor to submit the following report of a survey of harbor at South Milwaukee, Wis., with a view to ascertaining the feasibility and advisability of the construction of a harbor suitable for the needs of commerce at said port, in accordance with the requirements of section 14, river and harbor act approved June 13, 1902, together with a map[a] of the survey showing plans for said harbor, and an estimate of cost of same.

The harbor of South Milwaukee is situated at the mouth of Oak Creek, a small stream emptying into Lake Michigan about 10 miles south of the harbor of Milwaukee. The city of South Milwaukee is located on the high ground on either side of Oak Creek, and while a separate municipality, is really a manufacturing suburb of Milwaukee. The general elevation of the city above Lake Michigan is from 60 to 70 feet. Its population, according to the census of 1900, was 3,392.

Prior to 1891 there was a small hamlet, known as Oak Creek, where the city now stands. About the year mentioned, a syndicate, known as the South Milwaukee Company, acquired possession of a large tract of land surrounding and including the village of Oak Creek, platted it, and made a commencement on a harbor entrance at the mouth of the small creek, from which the original village derived its name by building two parallel pile piers 200 feet apart, the north pier being 600 feet long and the south pier 300 feet long, and by dredging between them to a depth of about 12 feet.

The harbor work done by this syndicate was of no benefit to commerce. The piers were built of all varieties of local timber, beech, hickory, cottonwood, etc., having been used for both piles and timber. The workmanship was of about the same quality as the materials. Neither pier is of any value for permanent harbor improvements, and in the present project for the improvement of this harbor it is provided that the piers built by the South Milwaukee Company shall be taken up and replaced by others of suitable material and construction.

The item in the river and harbor act approved August 18, 1894, appropriating $7,000 for improving harbor at Milwaukee, Wis., contained the following proviso: "and including survey of the harbor at South Milwaukee with a view to the improvement thereof." This survey was ordered without a preliminary examination, and was accordingly made under the direction of Maj. James F. Gregory, Corps of Engineers, U. S. Army, by Mr. J. A. B. Tompkins, C. E., whose report, with estimate of cost and maps of harbor and of proposed harbor entrance, was published in the Annual Report of the Chief of Engineers for 1895, page 2642 et seq. The estimated cost of the harbor entrance therein proposed was $138,000. Major Gregory made no report on this survey, the above-mentioned report being submitted by Capt. Carl F. Palfrey, Corps of Engineers, U. S. Army, without recommendation or comment, in his annual report for 1895.

The river and harbor act of June 3, 1896, appropriated $5,000 for the improvement of harbor at South Milwaukee. This money was expended on an extension of 185 feet to the north pier, built by the

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[a] Not printed.

South Milwaukee Company. It was not considered advisable to do any dredging until the piers should have been materially extended, as such as previously had been done by the South Milwaukee Company had proved valueless, the channel filling up soon after having been dredged.

In his annual report for 1896 Capt. Geo. A. Zinn, Corps of Engineers, U. S. Army, recommended an appropriation of $133,000 for the improvement of this harbor, this amount being the balance of the estimated cost after deducting the amount already appropriated. There is no doubt that this recommendation was made entirely from an engineering standpoint and without regard to commercial requirements. Congress, by appropriating $5,000, showed an intention of making a harbor at this place. Such being determined upon, it was desirable that the entire amount estimated as necessary to complete the project should be made available on account of economy of construction. In his annual reports for 1897 and 1898 Captain Zinn makes no further recommendations for appropriations, and with the exception of the one recommendation above mentioned, none has ever been made.

So far as is known, there has never been any commerce through the harbor, and at the present time the harbor is entirely valueless. The mouth of Oak Creek is nearly closed by a sand bar, and the depth of water between the piers varies from about 1 foot at the inner end to a maximum of about 11 feet at the outer end of the north pier.

The typical harbor on the west shore of Lake Michigan is located at and near the mouth of a river, and the improvements made by the United States consist of making the river available for purposes of commerce by forming and maintaining an entrance channel from the river mouth into Lake Michigan of such a width and depth as the needs of commerce demand, the channel being protected by parallel piers. The harbor proper is the river, along which docks and wharves are located, and the channel in the river is usually maintained by the municipality or private parties, the improvements made by the United States terminating at the shore line.

The present project for South Milwaukee, and which is shown on the map by broken black lines, provides for such an entrance to Oak Creek. To be of any practicable use for purposes of general commerce the interior channel or harbor in Oak Creek should be not less than 150 feet wide. The channel should be as nearly straight as possible, and should have a basin at or near its upper end, of sufficient area to permit vessels to be turned therein. There should be room on each side of the channel for wharves and warehouses, which should be easily accessible by railroad as well as by ordinary streets and roads. Furthermore, the interior harbor should be so located and protected as to be available at all times, and permit vessels to safely lie at their moorings under all conditions of weather.

The topography of the valley of Oak Creek and country immediately adjacent thereto is shown on the accompanying map, the land contours being drawn at vertical intervals of 5 feet above the datum plane, or zero of gauge. A proposed interior channel and turning basin is also shown on the map by broken red lines. The width of this proposed channel varies from 250 feet at the entrance to a least width of 150
t; the channel is provided with a turning basin of 300 feet diameter
upper end. The distance from the inner ends of the piers to

the center of turning basin is about 1,700 feet, and there is about 3,000 feet of wharf frontage on the two sides of the channel, exclusive of the turning basin. This proposed channel is believed to be the best attainable. It is believed, however, that this channel would be of but little practical benefit. As may be seen from the map, Oak Creek, which is shallow, is very crooked and lies at the bottom of a deep ravine the sides of which are very steep.

The bottom of this ravine is from 60 to 70 feet below the general level of the surrounding country. The material of the side slopes is clay, and there are numerous springs on each side of the ravine. At places, the proposed channel would require a side cutting of from 25 to 30 feet, which would carry the slopes practically to the top of the ravine. The resulting channel would be nothing but a canal, with no available room for wharves and warehouses, practically inaccessible by railroad, and only to be reached by ordinary roads by very steep grades. The channel would be exposed, and it is doubtful if vessels could lie safely moored at the wharves during a severe storm from an easterly quarter.

It is believed that it is neither feasible nor advisable to construct an interior harbor at this place, and therefore no estimate of the cost of the same is made. Two other plans for a harbor, however, remain to be considered, both being entirely artificial harbors, not dependent upon Oak Creek, and located directly in Lake Michigan. These plans are shown on the map in full red lines and are marked "A" and "B."

Plan A provides for a detached breakwater so arranged as to inclose a basin, access to which can be had from the lake by two entrances, each 300 feet wide. Wharves and slips are to be built along the shore as shown. The inclosed basin is to be dredged to a depth of 21 feet below datum. The breakwater is to be built and the dredging in the basin is to be done by the United States. The wharves and slips are to be built by private parties or by the city of South Milwaukee.

Under this plan, the present project is to be abandoned and Oak Creek diverted so as to flow into Lake Michigan to the north of the proposed harbor. Experience has shown that in the case of a small stream flowing into an artificial basin, considerable silt and alluvium is deposited by it, and in periods of freshet the amount becomes so great as to cause very appreciable shoaling.

Access to the wharves can be had by railroad, and the harbor would be capacious enough to accommodate the largest vessels engaged in the commerce of the lakes.

The breakwater is to be built of timber cribs filled with stone, and sunk on a pile foundation. The superstructure is to be of concrete. While the first cost of this style of construction would be greater than if built entirely of timber, it is believed that on account of the permanency of the work and the constantly increasing cost of timber it would be more economical. The cost of this breakwater would probably range from $75 to $175 per linear foot, the average being probably about $150.

The estimate of the cost of the breakwater and dredging is as follows:

| | |
|---|---|
| 3,500 linear feet of breakwater, at $150 per linear foot | $525,000 |
| 400,000 cubic yards dredging, at 15 cents per cubic yard | 60,000 |
| Contingencies, superintendence, etc., 6 per cent | 35,000 |
| Total | 620,000 |

No estimate is made of the cost of wharves and slips, but the cost of building same would probably be not far from $500,000.

Plan B provides for a small artificial basin inclosed by a pile pier to the north of the present entrance. This plan necessitates certain modifications of the present project. With the exception of the extension of 1897, the present north pier is to be entirely removed, and the inshore end of the projected north pier is to be abandoned. The south pier is to be built from the shore on a straight line, parallel to the north pier. The fender piling provided for in the present project is not to be built.

The basin will contain approximately 10 acres, and the west side of it, which would be available for wharves, is to be revetted by private parties and not by the United States. Oak Creek is to be diverted so as to discharge south of the harbor, for the same reasons as already given for plan A. The basin and entrance channel is to be dredged by the United States to a depth of 18 feet below datum, this being the present projected depth for this harbor. The estimate of the cost of plan B, exclusive of revetment, is as follows:

| | |
|---|---|
| 600 linear feet crib pier, at $90 per linear foot | $54,000 |
| 400 linear feet pile pier (18 feet wide), at $30 per linear foot | 12,000 |
| 2,315 linear feet pile pier (14 feet wide), at $25 per linear foot | 57,875 |
| 565,000 cubic yards dredging, at 15 cents per cubic yard | 84,750 |
| Tearing out 930 feet old pier, at $5 | 4,650 |
| Changing creek channel | 1,000 |
| Contingencies, superintendence, etc | 21,725 |
| Total | 236,000 |

If it should be desired to provide a depth of 21 feet below datum, the piers would have to be extended beyond their present projected length, and the foregoing estimate should be increased by about $64,000, making the total estimated cost of 21 feet of water, by plan B, $300,000.

While the pile pier inclosing the basin would be built almost entirely in Lake Michigan, it is believed that the shore line, which has advanced 300 feet in the past eight years, would continue to advance, so as eventually to extend outside of the proposed pier, thus forming an interior basin.

As regards the feasibility of the two plans A and B, above outlined, there is no doubt that the interests of a general and growing commerce would be better subserved by plan A. This plan provides for four slips, each 600 feet long and 150 feet wide, and in each of which two of the largest vessels on the lakes could lie at the same time. It is believed that ample wharfage is provided; all the wharves could be reached by railroad. The breakwater would thoroughly protect the inclosed basin so as to afford shelter at all times.

This plan is, however, a costly one, not only to the United States, but to the private parties and others who would be required to build the wharves and slips, the total estimated cost of the completed harbor being not less than $1,000,000 and possibly $1,500,000. It is not believed that either the present or any prospective commerce at South Milwaukee would justify so large an expenditure.

Plan B, which is merely a modification of plan A, is similar to the harbor at Waukegan, Ill., and Port Washington, Wis. At Waukegan, however, there is practically an unlimited area of low land to the northward of the harbor, which permits of indefinite extension, by means of a main channel with lateral slips. Such extension at South Milwaukee is impossible, as the beach is comparatively narrow, and the bluffs, the foot of which is but a short distance from the shore, are from 60 to 70 feet high.

The general topography at South Milwaukee Harbor more nearly resembles that at Port Washington Harbor, where two small artificial basins were constructed, and the Sauk River, a stream of about the same size as Oak Creek, was diverted to one side.

From experience had at Port Washington, it is believed that plan B would prove inadequate for anything except a small local commerce, and that the harbor would be available only in comparatively fair weather. It is not believed that its construction would result in any material benefit to general commerce.

Finally, as regards the general commercial interests that might be benefited, it must be said that there appears to be little or no reason for the construction of any harbor at this place. There are at the present time two deep-water harbors close to South Milwaukee, both of which have a depth of 21 feet; Milwaukee Harbor being about 10 miles north, and Racine Harbor about 13 miles south of South Milwaukee. At Milwaukee there is also a large harbor of refuge.

With a view to determining the commercial interests that might be benefited by the construction of a harbor, and also the probable extent of such benefits, I sent the following letter to Mr. Fred W. Rogers, secretary of the South Milwaukee Company:

MILWAUKEE, WIS., *March 9, 1903.*

DEAR SIR: The river and harbor act approved June 13, 1902, contained the following item:

"Harbor at South Milwaukee: Resurvey, with a view to the modification of the present plan of said harbor, and with a view to ascertaining the feasibility and advisability of the construction of a harbor suitable for the needs of commerce at said port, with plans and estimates of the same."

In accordance with the foregoing requirements a survey has been made and a map prepared under my direction. In order that the report on said survey may be complete, it is desirable that as full information as possible be had regarding the present and prospective commercial importance of South Milwaukee. I shall be pleased to have you fill out answers to the inclosed questions and return same to this office, together with any other information you may have on the subject.

I have to request that you will furnish me with the names of prominent business houses at South Milwaukee that I may also send to them blanks to be filled out in order that the information may be complete as possible.

Very respectfully,

J. G. WARREN,
*Major, Corps of Engineers.*

MR. FRED W. ROGERS,
*Secretary, South Milwaukee Company, Milwaukee, Wis.*

Similar letters, with inclosures, were also sent to the mayor of South Milwaukee, the Bucyrus Company, and to Mr. Byron E. Walter, president of the Advancement Association. With the exception of letters of acknowledgement, the only reply received was the following:

Please fill out answers to the following questions relative to the commerce of South Milwaukee, Wis., and return in inclosed official envelope to Maj. J. G. Warren, Corps of Engineers, U. S. Army, Milwaukee, Wis. Exact figures are not necessary; reasonably close approximations are all that are required.

(1) What are the annual receipts of coal? 50,000 tons.

(2) What are the annual receipts of lumber? 7,000,000 feet B. M.

(3) What is the total commerce? Imports, 120,000 tons; exports, 90,000 tons.

(4) (*a*) In the event of increased harbor facilities, in your opinion what percentage of the foregoing would be shipped by water? Imports, 40 per cent; exports, 20 per cent.

(b) In your opinion, what would be the principal articles shipped by water? Coal, coke, lumber, brick, lime, iron, farm products, stone, and general merchandise.

(5) What are the principal manufactures of South Milwaukee? Steam shovels and dredges, merchant bar iron, horseshoes, baskets, sash, doors and blinds, glue, whisky, office furniture, gray iron, malleable castings and merchant hardware, packing boxes, and fire engines.

(6) Please state any other facts or information not above enumerated bearing upon this subject. (No answer.)

C. FRANKE, *Mayor*.
BYRON E. WALTER, *Advancement Association*.

From this one report it would appear that the commerce is and would be entirely local and of only moderate amount. Some coal and lumber might be received by vessel, but it is doubtful if the exports by way of the harbor would be of any importance.

Several manufacturing establishments are located at South Milwaukee, and their combined output is undoubtedly large and important; but it is such as would naturally be shipped by rail rather than by water. Furthermore, these establishments are located from half a mile to a mile and a half from the harbor, so that a transfer by drays or other mode of conveyance between them and the docks would be necessary.

On account of the topography of South Milwaukee it would be practically impossible to locate manufacturing establishments directly at the harbor under any of the proposed plans. It might be possible to locate coal docks, but the coal would have to be hauled up very steep grades and for a considerable distance; and it is probable that the various manufacturing establishments, which would be the largest consumers, could obtain their coal from Milwaukee by rail, delivered at their plants, cheaper than by way of the harbor. The same is true as regards lumber.

South Milwaukee is on the main line of the Chicago and Northwestern Railway between Chicago and Milwaukee, and is connected by electric railway with Milwaukee and Racine. Passenger travel is therefore amply provided for, and with the exception of possible excursions on Sundays and holidays, it is doubtful if there would be any passengers to or from this place by way of the harbor.

In view, therefore, of the difficulties and excessive cost of building a harbor suitable for the requirements of general commerce, of the close proximity of Milwaukee and Racine harbors, and of the purely local nature of the commerce of South Milwaukee, it is believed that present and prospective commerce does not justify the construction of a harbor at this place.

Very respectfully, your obedient servant,

J. G. WARREN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., April 13, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that it is not advisable to construct a harbor at South Milwaukee.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 18, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the report of the district officer and the indorsement of the division engineer relating to plans and estimates for the further improvement of the harbor at South Milwaukee based upon a "resurvey, with a view to the modification of the present plan of said harbor, and with a view to ascertaining the feasibility and advisability of the construction of a harbor suitable for the needs of commerce at said port." A committee of the Board inspected the locality on June 23, 1903, and on the same day held a public hearing at Milwaukee, at which interested persons were given opportunity to express their views.

South Milwaukee is but 10 miles south of Milwaukee, Wis., of which city it is a manufacturing suburb. About ten years ago two piers, 200 feet apart and 600 and 300 feet long, respectively, were constructed in this locality at the mouth of Oak Creek by a local land company, and the area between the piers was dredged to a 12-foot depth.

No preliminary examination of the locality on the part of the United States has been made hitherto, but based upon a survey of the harbor with a view to its improvement, directed in the river and harbor act of August 18, 1894, an appropriation of $5,000 was made in 1896, and this sum was expended in extending the north pier 185 feet. The effect of this appropriation was apparently the adoption by Congress of a project to improve the harbor at a total cost, as ascertained from the survey above mentioned, of $138,000.

By reason of the bluffs adjacent to Oak Creek, which would not permit the convenient use of the same for dock purposes, even if this very small stream were dredged to the requisite depth and width, it is the opinion of the district officer, concurred in by the Board, that no suitable inner harbor of the common lake type can be formed at South Milwaukee.

It appears that an outer harbor of very limited capacity adequate for but a small local commerce and unsafe in storms would cost $236,000. The estimate for a safe outer harbor of capacity sufficient to accommodate at wharves simultaneously eight large lake carriers is $620,000. In the latter case the construction of wharves by private parties would be a very expensive undertaking, probably equaling in cost the breakwater harbor itself.

The proximity of Milwaukee would probably prevent the development of a general commerce. Inbound shipments would be for local, private, or factory consumption, and outbound shipments would consist of but a small proportion of the articles locally manufactured.

The following are the more important manufacturing plants at South Milwaukee:

The Bucyrus Company, manufacturing steam shovels, dredges, etc.
Eagle Horseshoe Company, manufacturing bar iron and steel, horseshoes, etc.
Stowell Manufacturing and Foundry Company, manufacturing miscellaneous hardware.
The Whitmore Company.
Stollenwerk & Weber Box Factory.

All shipments to and from South Milwaukee are by rail. Incomplete returns from interested parties indicate approximately the following annual receipts:

| | Tons. |
|---|---|
| Coal | 50,000 |
| Lumber | 10,000 |
| Iron and steel | 30,000 |
| Miscellaneous | 30,000 |
| Total | 120,000 |

The shipments from South Milwaukee aggregate about 90,000 tons annually, mostly of wood and metal manufactures.

The freight rate on coal received at South Milwaukee exceeds by 25 cents per ton the rail and water rate at Milwaukee. If there were a harbor at South Milwaukee, considerations of return freight, inferior unloading facilities, etc., might be expected to increase the rates on coal to that harbor over the Milwaukee rate. Moreover, there would be a charge for hauling the coal from the harbor to the factories—a considerable distance in some cases—whereas coal received by rail is delivered conveniently to the consumer. The same reasoning applies to the lumber and pig-iron receipts.

It is not believed that the benefits arising from the construction of a harbor at South Milwaukee would now be commensurate with the cost. It is therefore the opinion of the Board that it is not advisable for the United States at this time to construct a harbor at South Milwaukee.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## J J 24.

### PRELIMINARY EXAMINATION OF HARBOR AT STONE HAVEN, WISCONSIN.

[Printed in House Doc. No. 218, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith a report, dated July 21, 1902, by Maj. J. G. Warren, Corps of Engineers, on preliminary examination of harbor at Stone Haven, Wis., with a view to the improvement of the same by the construction of piers, or otherwise, to meet the demands of commerce at this port, made in pursuance of a requirement of the river and harbor act approved June 13, 1902. Major Warren is of the opinion, concurred in by Lieut. Col. O. H. Ernst, Corps of Engineers, the division engineer, that the improvement of the locality by the General Government is not advisable.

This report has been reviewed by the Board of Engineers for Rivers and Harbors, in pursuance of sections 3 and 14 of the above-mentioned act, and the Board states in its report, dated March 17, 1903, that it believes that the improvement of harbor at Stone Haven by the construction of piers, or otherwise, is not justified by the demands of commerce at this port, and that it is not desirable for the United States to undertake the improvement.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### REPORT OF MAJ. J. G. WARREN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE.
*Milwaukee, Wis., July 21, 1902.*

GENERAL: I have the honor to submit the following report upon a preliminary examination made at Stone Haven, Wis., in accordance with instructions contained in letter from Office of the Chief of Engineers, United States Army, dated June 23, 1902, and to comply with requirements of an item in section 14 of act approved June 13, 1902, which reads as follows: "Harbor at Stone Haven, with a view to the improvement of the same by the construction of piers or otherwise to meet the demands of commerce at this port."

Stone Haven, so called, is located on the west shore of Lake Michigan, and about 8 miles north of Port Washington, Wis. The village of Belgium, a station on the Chicago and Northwestern Railway and situated about 2½ miles west of Stone Haven, is the nearest railway shipping point.

The lake bottom in the vicinity of Stone Haven is generally a thin layer of sand, overlying the limestone rock. There is no river or creek flowing into Lake Michigan at Stone Haven, and the locality offers no natural advantages for a harbor. Any harbor that might be constructed at this place would consist of an artificial basin formed by inclosing a portion of the lake with piers and breakwaters.

There is a large limestone quarry located at Stone Haven, and on March 22, 1900, the Secretary of War granted a permit to the Lake Shore Stone Company, a corporation owning and operating the quarry, to build and maintain a pier extending 1,000 feet from the shore into Lake Michigan. A crib pier has been built in accordance with the terms of the permit, and on the outer end an elevator for handling and storing crushed stone has been constructed, and to which the stone is carried by means of a tramway built along the pier. The depth of water in the vicinity of the elevator is about 14 feet.

The pier affords but slight protection to vessels lying alongside of it, and is practically no more than a "bridge" pier, such as was used in former years at various harbors before their improvement was begun by the United States.

While the Lake Shore Stone Company have displayed much enterprise in developing their property, and have been under heavy expense in making the quarry accessible to vessels by means of the pier before mentioned, their business constitutes the only commerce now existing at Stone Haven that would be benefited by the proposed harbor. The surrounding country is purely agricultural, and it is believed that not only present but prospective commerce, other than that originating at the quarry of the Lake Shore Stone Company, would be in no manner benefited by the proposed improvement.

The harbor of Port Washington, Wis., situated about 8 miles south, has a depth of 13 feet below datum, and the harbor of Sheboygan, Wis., about 19 miles north, has a depth of 19 feet, which, under the project authorized by act of June 13, 1902, will be increased to 21 feet below datum. It is believed that the present needs of general commerce are fully subserved, and that a harbor at Stone Haven is unnecessary.

For the foregoing reasons, therefore, the improvement of the locality by the General Government in any manner whatsoever is not recommended.

Very respectfully, your obedient servant,

J. G. Warren,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[Third indorsement.]

Office Division Engineer, Northwest Division,
*Chicago, Ill., August 1, 1902.*

Respectfully returned to the Chief of Engineers.

I concur in the opinion that the improvement of this locality is not advisable.

O. H. Ernst,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 12, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Fifth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has given due consideration to the within report of the district officer, the indorsement of the division engineer thereon, and a letter from the Lake Shore Stone Company interested in the improvement.

Stone Haven has no natural advantages for a harbor, and there is a harbor of general utility 8 miles to the south and another 19 miles to the north of this locality.

The only commerce involved is that originating from a single private industry, and, in the opinion of the Board, no general commerce would result from the desired improvement.

The cost of an artificial harbor would be large and entirely disproportionate to the resulting commercial benefits.

The Board therefore believes that the improvement at Stone Haven by the construction of piers, or otherwise, is not justified by the demands of commerce at this port, and that it is not desirable for the United States to undertake this improvement.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

# APPENDIX K K.

## IMPROVEMENT OF CHICAGO AND CALUMET HARBORS AND CHICAGO RIVER, ILLINOIS, AND OF CALUMET RIVER, ILLINOIS AND INDIANA; SURVEY OF ILLINOIS AND DES PLAINES RIVERS, ILLINOIS, FOR WATERWAY FROM LOCKPORT, ILLINOIS, TO ST. LOUIS, MISSOURI.

*REPORT OF COL. O. H. ERNST, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Chicago Harbor, Illinois.
2. Chicago River, Illinois.
3. Calumet Harbor, Illinois.
4. Calumet River, Illinois and Indiana.
5. Survey of Illinois and Des Plaines rivers, Illinois, for waterway from Lockport, Illinois, to St. Louis, Missouri.

EXAMINATION.

6. Calumet River, Illinois.

UNITED STATES ENGINEER OFFICE,
*Chicago, Ill., July 15, 1904.*

GENERAL: I have the honor to forward herewith the annual reports upon the works in my charge for the fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

O. H. ERNST,
*Colonel, Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

## K K 1.

## IMPROVEMENT OF CHICAGO HARBOR, ILLINOIS.

*Outer basin.*—This basin originally covered 455 acres of the area of Lake Michigan, of which 270 acres lie seaward of the dock line established by the Secretary of War September 22, 1890, and 185 acres west of this dock line. The dock line is about 1,300 feet east of the right of way of the Illinois Central Railroad and 2,000 feet distant from and parallel to the easterly breakwater of the basin.

Under authority granted by the Secretary of War July 24, 1895, a bulkhead has been constructed along the dock line, and the area shoreward of the dock line is now being filled in by the city of Chicago for a public park. Of the remaining area, 3,000 feet in length, extending southwardly from the river, by about 1,150 feet in width, comprising about 79 acres, has been dredged to a depth of 21 feet below Chicago city datum, the contract for which was closed December 6, 1902. During the year irregular dredging has been done in this area by the park commissioners of the city of Chicago, for the purpose of filling behind the dock line for the park.

The dredging done in former years resulted in a 21-foot channel in the river from Pine street to the lake and the same depth over the bar at the harbor entrance as well as over the 79 acres of the basin mentioned above.

The piers and breakwaters, except the north pier, are generally in fair condition. Being constructed of wooden cribs, ballasted with stone, their superstructures must all, in course of time, be rebuilt; but unless some unexpected accident should occur, that work may be deferred several years for all except the north pier. That pier has suffered from fire and collisions, as well as decay, and it is proposed to replace the superstructure with concrete, in accordance with the sketch submitted with the last annual report, when funds become available.

It is proposed to use the funds now available and those recommended for appropriation for the fiscal year ending June 30, 1905, in dredging the outer basin, in maintaining existing works, and in rebuilding the superstructure of the north pier in concrete.

There was no contract in force in Chicago Harbor during the fiscal year 1904.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $2,442.94 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 768.39 |
| July 1, 1904, balance unexpended | | 1,674.55 |
| Amount (estimated) required for completion of existing project | | 409,960.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $285,000.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 295,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

---

LIST OF APPROPRIATIONS FOR HARBOR AT CHICAGO, ILL.

| By act of— | |
|---|---|
| July 11, 1870 | $100,000.00 |
| March 3, 1871 | 100,000.00 |
| June 10, 1872 | 90,000.00 |
| March 3, 1873 | 90,000.00 |
| June 23, 1874 | 75,000.00 |
| March 3, 1875 | 78,000.00 |
| August 3, 1876 | 5,000.00 |
| June 18, 1878 | 75,000.00 |
| March 3, 1879 | 75,000.00 |
| June 14, 1880 | 145,000.00 |
| March 3, 1881 | 150,000.00 |
| August 2, 1882 | 200,000.00 |
| July 5, 1884 | 100,000.00 |
| August 5, 1886 | 75,000.00 |
| August 11, 1888 | 200,000.00 |
| September 19, 1890 | 100,000.00 |

| By act of— | |
|---|---|
| July 13, 1892 | $72,000.00 |
| August 18, 1894 | 80,000.00 |
| March 3, 1899 | 100,000.00 |
| Total appropriated | 1,910,000.00 |
| Received from all sources since 1870 (transfer of tugs, sales, etc.) | 921.16 |
| Total | 1,910,921.16 |
| Expenditures to June 30, 1904 | 1,909,246.61 |
| Balance unexpended June 30, 1904 | 1,674.55 |

### COMMERCIAL STATISTICS.

*Receipts and shipments by lake at Chicago during calendar year 1903.*

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coal | 985,133 | Wheat | 175,970 |
| Iron ore | 108,792 | Corn | 1,114,802 |
| Hardware | 25,468 | Oats | 148,691 |
| Lumber | 866,156 | Rye | 41,656 |
| Shingles | 5,870 | Flour | 272,092 |
| Lath | 210 | Grass seeds | 1,232 |
| Posts | 38,944 | Mill stuffs | 57,519 |
| Ties | 91,979 | Malt | 3,891 |
| Poles | 36,316 | Oil cake | 16,304 |
| Wood | 18,485 | Spelter | 1,811 |
| Salt | 206,708 | Lead | 2,914 |
| Plaster | 14,105 | Glucose | 14,061 |
| Cement | 115,258 | Sugar | 7,077 |
| Whiting | 11,017 | Oil | 9,185 |
| Asphalt | 7,173 | Pork | 538 |
| Copper | 10,678 | Beef | 50 |
| Hides | 776 | Tallow | 5,072 |
| Wheat | 86,640 | Starch | 9,658 |
| Flaxseed | 24,976 | Broom corn | 733 |
| Oats | 1,205 | Hides | 504 |
| Coffee | 14,616 | Leather | 473 |
| Liquors | 18,670 | Wool | 5,391 |
| Sugar | 250,122 | Groceries | 17,910 |
| Groceries | 252,455 | Unclassified | 369,814 |
| Stone | 15,900 | | |
| Unclassified | 630,553 | | |
| Total | 3,828,205 | Total | 2,277,348 |

*Comparison of receipts and shipments for years 1894 to 1903, inclusive.*

| Year. | Tons. | Year. | Tons. |
|---|---|---|---|
| 1894 | 7,209,236 | 1899 | 6,189,365 |
| 1895 | 7,205,942 | 1900 | 5,873,070 |
| 1896 | 6,347,163 | 1901 | 6,184,212 |
| 1897 | 7,149,759 | 1902 | 5,184,792 |
| 1898 | 7,391,454 | 1903 | 6,105,553 |

Amount of revenue collected during fiscal year 1904 .................. $8,141,662.07

*Arrivals and clearances of vessels, Chicago Harbor.*

| | Arrivals. | | Clearances. | |
|---|---|---|---|---|
| | Number. | Tons. | Number. | Tons. |
| Steam | 5,164 | 4,237,197 | 5,079 | 4,166,225 |
| Sail | 573 | 189,175 | 583 | 190,094 |
| Total | 5,737 | 4,426,372 | 5,662 | 4,356,319 |

### REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

United States Engineer Office,
*Chicago, Ill., July 1, 1904.*

Colonel: I have the honor to submit the following report on operations in Chicago Harbor, Illinois, during the year ending June 30, 1904:

There was no contract in force during the year for any work of improvement of this harbor, and no such work was done.

### CONDITION OF THE WORKS ON JUNE 30, 1904.

*The south pier.*—The superstructure over this pier was rebuilt in 1893. It is in reasonably fair condition, save in scattered places where the top side timbers and cross-ties have been damaged by vessels and tugs that moor along the pier, fastening their lines to the ties.

*The north pier.*—West of the "Light-house slip" this pier is entirely occupied by private parties—except the part used by the Light-House Department—and this part of the pier is in fair condition. The superstructure of the portion east of the slip is in a state of extreme decay. It was rebuilt, eight courses in height, in 1891. Several fires, together with collisions with vessels and the work of the elements, have brought about this condition, which requires a new superstructure in accordance with the project submitted to the Department with last year's report. The pile protection at the outer end is also badly broken up.

*The easterly breakwater.*—The superstructure was rebuilt in 1891. It is in very fair condition, save some decay in the decking and top side timbers in scattered places, especially in the southerly and more exposed portion, and in two places where collisions with vessels have occurred, viz, one very bad break on the east side, 650 feet from the north end, where the steamer *Kalamazoo*, of the Williams Line, ran into it on July 3, 1901; the other about midway on the west side, where a comparatively slight damage has been done by some unknown vessel. The pile protection at the westerly end of the "return" is broken up, but a clump of 13 piles remains in good condition as a protection in front of this place. The new life-saving station at the north end is completed, but not yet occupied.

*The southerly breakwater.*—The superstructure was rebuilt in 1893. It is generally in fair condition and similar to that over the easterly breakwater. Deck planks are, however, decayed or lost in scattered places, this being especially the case toward the outer or easterly end, which is most exposed to seas. One of the clumps of piles at the north end is broken up and has only two piles left.

*The exterior breakwater.*—The superstructure was rebuilt in 1894 to 1895 and is generally in good condition, save some slight damages done by unknown vessels.

*Channel at the entrance.*—There is an available channel with not less than from 20.5 to 22 feet below Chicago city datum from the lake to Rush Street Bridge. The Illinois Central Railroad Company's bridge near the mouth of the river has now been removed.

*Miscellaneous remarks.*—In October, 1903, the existence of two shallow places in the vicinity of the harbor were reported to this office and investigated, viz: (1) Opposite the private pier at Thirtieth street, 2,100 feet from its outer end. This was found to consist of clay, with a depth of 14 feet over it, about 20 feet in diameter and surrounded by water 20 feet in depth. It was entirely removed on the 23d of November, 1903. (2) At a point south 30° 17′ west, 1.69 miles distant from the Lake View crib and south 39° 45′ east, 1.62 miles distant from the Lake View pumping station at the foot of Montrose Boulevard. The shoal appeared to consist of a pile of rubblestone. The shallowest place found was 13 feet and the place was surrounded by depths varying between 19 and 21 feet. The ore-laden steamer *Wawatam*, which struck this shoal, was probably not less than a mile to the eastward of its proper course.

The outer portion of the old "Casino pier" at Jackson Park has been removed in part. The inner 1,400 feet are to be rebuilt. Electric lights will be maintained at the outer end of the old work until it has been ascertained that no submerged piles remain in place.

### WORK PROPOSED FOR THE YEAR ENDING JUNE 30, 1905.

There being at present no funds available for the improvement of this harbor, no work is now proposed for the ensuing year.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. Liljencrantz,
*Assistant Engineer*

Col. O. H. Ernst,
*Corps of Engineers.*

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## K K 2.

## IMPROVEMENT OF CHICAGO RIVER, ILLINOIS.

This river constitutes the inner harbor of Chicago, Ill. Its navigable parts lie wholly within the city limits of Chicago.

In the Annual Report of the Chief of Engineers for 1893, page 2974, may be found a full report upon this stream and its needed improvement, and in his Annual Report for 1897, page 2793, a history of the improvement and some detailed information as to the obstructions to navigation existing along its channels. Reference is made in his Report of 1902, page 2097, to the work undertaken by the sanitary district of Chicago in connection with the improvement of this river.

At the close of the fiscal year ending June 30, 1902, the project under the act of June 3, 1896, as modified by the act of June 4, 1897, for improvement by dredging to allow passage by vessels drawing 16 feet of water, and to cut away certain obstructive bends and projecting docks, had been completed.

During the fiscal year just closed no work was done by the United States, but the sanitary district of Chicago continued its work of improvement, having dredged 197,611 cubic yards of material and built 1,248 linear feet of wooden dock, and 3,275 cubic yards of concrete dock. For this information I am indebted to Mr. Isham Randolph, chief engineer of the sanitary district.

The securing of the 22 tracts of land necessary for the two turning basins provided for by act of Congress of June 13, 1902, has been diligently prosecuted. Purchases were made by agreement with the owners wherever practicable, 5 tracts being thus secured during the year in addition to the 2 tracts secured last year. Ten tracts have been condemned, but not paid for; the certified transcript of the record of proceedings in the United States district court, with abstracts of title and other papers, have been forwarded to the Attorney-General for his approval before making payment therefor. One tract was ceded by act of the Illinois State legislature approved May 13, 1903. One tract has been omitted by authority of the Secretary of War dated May 21, 1904. The title papers for the remaining 3 tracts are now ready to be forwarded to the Attorney-General for his approval.

The draft of vessels navigating the Chicago River is limited to about 16 feet, there being only about 17 feet of water over two of the tunnels under the river, and about 18 feet over the third.

Congress, by act approved April 27, 1904. declared these tunnels unreasonable obstructions to the free navigation of the river and made it the duty of the Secretary of War to give notice to the persons or corporations owning or controlling them so to alter them as to render navigation over them free, easy, and unobstructed. Under instructions from the Chief of Engineers, I made an investigation of all the facts concerning the tunnels, and submitted a report on May 26, 1904, which was published as War Department Document No. 227.

Complaints from the navigation interest having been received against the Illinois Central Railroad bridge near the mouth of the river, a public hearing was held November 21, 1903, at which all parties in interest were given an opportunity to be heard. As a result thereof the Secretary of War, under date of December 22, 1903, ordered the company to remove the bridge and pier to a depth 22 feet below Chicago city datum. After some delay, due to a protest from the company and a rehearing of the case by a Board of Engineer Officers, the bridge and pier were finally removed about the end of the fiscal year. A slight deficiency in depth was found at the site of one of the rest piers which the company promptly agreed to remedy.

There was no contract in force in Chicago River during the fiscal year 1904.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $345,341.53 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 22,903.21 |
| July 1, 1904, balance unexpended | 323,901.32 |
| July 1, 1904, outstanding liabilities | 139,115.64 |
| July 1, 1904, balance available | 184,785.68 |

### APPROPRIATIONS.

| | |
|---|---|
| Act of June 3, 1896 | $50,000.00 |
| Sundry civil act, June 4, 1897 | 113,000.00 |
| Sundry civil act, July 1, 1898 | 400,000.00 |
| Sundry civil act, June 6, 1900 | 62,000.00 |
| Act of June 13, 1902 | 306,457.00 |
| Received from sale of property | 1,481.12 |
| Total | 932,938.12 |
| Expenditures to June 30, 1904 (exclusive of $25,000 allotted from appropriation for Chicago Harbor of August 18, 1894) | 609,036.80 |
| Balance unexpended July 1, 1904 | 323,901.32 |

## REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

United States Engineer Office,
*Chicago, Ill., July 2, 1904.*

Colonel: I have the honor to submit the following report on operations in Chicago River, Illinois, during the fiscal year ending June 30, 1904:

There was no contract in force during the year for any work of improvement of this river, and no such work was done.

### WORK DONE DURING THE YEAR.

In the matter of securing titles to the tracts of land required for the construction of the two proposed turning basins, the following progress was made:

The land required was divided, according to ownership or location, into 6 tracts for the North Branch basin and 16 for the South Branch basin. Prior to July 1, 1903, 3 of these tracts had been secured, viz, Nos. 1 and 2 of the north basin, by purchase, and No. 13 of the south basin, ceded by act of the State legislature.

During the year there have been secured 5 tracts by purchase, Nos. 1, 2, 3, 5, and 16 of the south basin. Ten tracts were condemned between the 6th and 14th of April last, viz, Nos. 4, 5, and 6 of the north basin, and 7, 8, 9, 10, 11, 12, and 14 of the south basin. The court record, with judgments, etc., in these cases, were forwarded to the Attorney-General for his approval on June 17 and 18—for tracts 5 and 6, north basin, on the latter date, and for the others on the former.

Under authority from the Secretary of War of May 21, 1904, it was decided to omit tract No. 3, north basin, as it would not materially affect the usefulness of that basin, and as the sum of $7,513 would thereby be saved and to that extent counterbalance the increase in the amounts of the verdicts above the appraised valuation.

The title papers for three tracts, Nos. 4, 6, and 15, south basin, the Chicago Terminal Transfer Railroad Company's property, are about ready to be forwarded to the Attorney-General for approval.

The payments made, or to be made for all the land to be acquired, as compared with the originally appraised valuations, including the buildings on the land, leaseholds and damages to remaining land, but not including docks to be built or other work to be done, nor expenses of the condemnation suits, are as follows:

| | Appraised values. | Paid or to be paid. |
|---|---|---|
| North Branch basin: | | |
| Tract 1 | $112,544.00 | $112,544.00 |
| Tract 2 | 41,863.57 | 41,863.57 |
| Tract 3 | 3,575.00 | 0.00 |
| Tract 4 | 4,896.80 | 4,896.80 |
| Tract 5 | 8,976.00 | 9,302.40 |
| Tract 6 | 49,978.50 | 63,339.40 |
| Total for north basin | 221,833.87 | 231,946.17 |
| South Branch basin: | | |
| Tract 1 | 2,199.75 | 2,199.75 |
| Tract 2 | 3,037.50 | 3,037.50 |
| Tract 3 | 3,375.75 | 3,375.75 |
| Tract 4 | 2,000.00 | 2,000.00 |
| Tract 5 | 1,076.00 | 1,076.00 |
| Tract 6 | 5,676.12 | 5,676.12 |
| Tract 7 | 625.00 | 750.00 |
| Tract 8 | 1,125.00 | 1,350.00 |
| Tract 9 | 1,125.00 | 1,350.00 |
| Tract 10 | 3,667.39 | 4,741.74 |
| Tract 11 | 523.25 | 627.90 |
| Tract 12 | 2,435.46 | 2,666.26 |
| Tract 13 | 19,503.32 | 0.00 |
| Tract 14 | 27,822.76 | 27,822.76 |
| Tract 15 | 14,592.26 | 14,592.26 |
| Tract 16 | 6,685.75 | 6,685.75 |
| Total for south basin | 95,470.31 | 77,951.79 |
| RECAPITULATION. | | |
| For North Branch basin | 221,833.87 | 231,946.17 |
| For South Branch basin | 95,470.31 | 77,951.79 |
| Total | 317,304.18 | 309,897.96 |

| | |
|---|---|
| Difference, representing amount saved | $7,406.22 |

The sum thus saved in securing the necessary land was somewhat increased through payments made by private parties, duly authorized by the Secretary of War, as follows:

| | |
|---|---|
| For wrecking the buildings on tract 2, North Branch basin | $150.50 |
| For removing black soil from tracts 1 and 2, North Branch basin | 216.50 |
| Total | 367.00 |

A further increase in this amount will be made when the buildings on land taken for the South Branch basin are sold.

Two lines of soundings were run from Rush Street Bridge to the junction, in the main branch of the river, and thence to Belmont avenue in the north branch, viz: one line through the right-hand channel and the bridge draws, the other through the left-hand channel, to ascertain, approximately, the prevailing depths. The result showed as follows, the depths having reference to city datum:

From Rush street to the junction the available depth was found to be from 17.5 to 21 feet, except 16.5 feet in the north draw of Rush Street Bridge, which is seldom if ever used by any other boats than tugs; 17 in mid-channel across La Salle street tunnel and 16.5 feet in the northerly channel near the point opposite Lake Street Bridge. The southerly channel is the deepest, generally from 18.5 to 21 feet.

From the junction to Chicago avenue, the available depth is 18.5 to 20 feet, except in the east draws at Kinzie street, where only 10.5 to 11.5 feet were found; near and in the east draw of Indiana Street Bridge, 15.5 to 16.5 feet.

Chicago avenue to North avenue, 17 to 20 feet, except at Division and Blackhawk street bridge, east channels, 16 to 16.5 feet.

North avenue to Fullerton avenue, 16 to 18 feet, except at Chicago, Milwaukee and St. Paul Railway bridge, 14.5 to 15.5 feet; in the east draw, Webster Avenue Bridge, 15.5 feet; at North Western Railway bridge, west draw, 15 feet at and near Fullerton Avenue Bridge, west draw, 8.5 to 9.5 feet, and in the east draw 10.5 to 17 feet.

Fullerton avenue to Belmont avenue, from 15.5 to 17 feet, except 14.5 feet in the east draw of Diversey Avenue Bridge and in the channel through the temporary bridge at north Western avenue and 9.5 feet to 15 feet near Belmont avenue.

The North Branch Canal has a channel, through the middle, of at least 17.5 feet, but generally from 18.5 to 20.5 feet.

### WORK PROPOSED FOR THE ENSUING YEAR.

As soon as all the legal papers, now in the hands of the Attorney-General, or about to be sent to him, have been approved it is proposed to pay for the land not yet secured; to advertise for proposals for the work of construction, after the specifications for this work have been prepared and approved by the Department; to dispose of buildings remaining on the land and to begin actual operations.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. Liljencrantz, *Assistant Engineer.*

Col. O. H. Ernst,
*Corps of Engineers.*

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## K K 3.

## IMPROVEMENT OF CALUMET HARBOR, ILLINOIS.

The object of the work originally was to provide a deep entrance to the Calumet River and the port of South Chicago. Under the latest project it is also to provide a harbor of refuge and anchorage ground in front of the river mouth, as well as an easy approach to the entrance.

The first object is accomplished by first protecting the proposed channel by parallel piers 300 feet apart, projecting into the lake from the shore, and then dredging between them to the proper depth. Work was begun in 1870, and by the 30th of June, 1876, 2,020 linear feet of the south pier and 3,640 feet of the north pier had been completed, and a channel 16 feet deep between the piers had been secured, which completed the old project.

By the act of June 3, 1896, the project was enlarged so as to provide for an extension of the piers and an increase in the channel depth to 20 feet.

By the act of March 3, 1899, it was still further enlarged so as to provide for—

1. A breakwater 4,400 feet long connected with the shore and running due east into the lake, terminating in water 32 feet deep.
2. A second breakwater about 2,000 feet long running in a southerly direction from the outer end of the first, but detached therefrom, the interval between the two breakwaters to be not less than 2,500 feet, the exact location of the second breakwater and the necessity of building it to be left for determination after completion of the first.
3. The anchorage area sheltered by those breakwaters to be dredged to 20 feet depth.
4. Extending the south pier at the mouth of the Calumet, 800 feet.
5. Dredging in the Calumet River to a width of 200 feet and depth of 20 feet for a distance of 2 miles from the mouth.

The act of June 13, 1902, authorized a modification of the first and second items by substituting for the detached breakwater an extension in a southeasterly direction of the first breakwater for a distance not to exceed 2,500 feet. (See sketch VI accompanying last annual report.)

At the beginning of the fiscal year all of the above work had been completed except the first item, work on which was begun April 23, 1903, and the third item, which was 91 per cent completed. This third item, dredging the area sheltered by breakwaters, which was being prosecuted under a contract with the Lydon & Drews Company, of Chicago, entered into March 19, 1902, was completed November 16, 1903, the total amount of material dredged under the contract being 1,440,734 cubic yards, of which 207,523 cubic yards were removed during the fiscal year. The payments under this contract aggregated $229,076.71. The result accomplished was the deepening to 21 feet below Chicago city datum of the area sheltered by the breakwaters and the channel between the piers, thus giving an unobstructed approach to the harbor from deep water in the lake to the entrance to the Calumet River, as well as affording ample anchorage ground protected from northerly winds.

For the extension of the breakwater in a southeasterly direction a contract was entered into November 12, 1902, with the firm of Gillen & Gillen, of Racine, Wis., and work was begun April 23, 1903. The following work has been accomplished under this contract; 1,600 feet of stone foundation completed; 15 cribs, each 30 by 100 feet, 24 courses high, sunk in place and filled with stone; 500 feet of superstructure, including decking, completed; about 200 feet of ice guard placed. The payments to the contractors aggregate $98,948.02.

Under a special agreement entered into with the firm of Gillen & Gillen for repairing the damage to the breakwater inflicted by the steamer *Mataa* of the Pittsburgh Steamship Company, December 9, 1902, the work was done at a cost of $7,014.19, exclusive of inspection charges. Suit to recover the cost of repairing this damage has been brought by the United States against the steamship company in the United States district court for the district of Minnesota, and is still pending.

The piers and breakwaters are in good condition except the superstructure over the inner or westerly 1,200 feet of the south pier, which was built in 1892 and will require rebuilding at an early date.

The self-registering gauge was maintained throughout the year and a table of daily and monthly means was constructed for each month. The original rolls and a copy of the tables have been sent to the lake survey office for preservation and for use in the study of the general hydraulics of the Great Lakes. Sudden, extreme fluctuations were observed only once. On August 5, the level of the lake fell 2.35 feet in one hour, between 12.20 and 1.20 p. m.

It is proposed to apply the funds now available to the continuation of the extension of the east and west breakwater in a southeasterly direction and to the necessary repair and maintenance of the works.

## *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $464,020.07 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $154,445.39 | |
| For maintenance of improvement | 7,876.00 | |
| | | 162,351.39 |
| July 1, 1904, balance unexpended | | 301,668.68 |
| July 1, 1904, amount covered by uncompleted contracts | | 165,572.23 |

APPROPRIATIONS.

| By act of— | |
|---|---|
| July 11, 1870 | $50,000.00 |
| March 3, 1871 | 50,000.00 |
| June 10, 1872 | 40,000.00 |
| March 3, 1873 | 40,000.00 |
| June 23, 1874 | 25,000.00 |
| March 3, 1875 | 25,000.00 |
| August 2, 1876 | 20,000.00 |
| June 18, 1878 | 15,000.00 |
| March 3, 1879 | 12,000.00 |
| June 14, 1880 | 20,000.00 |
| March 3, 1881 | 30,000.00 |
| August 2, 1882 | 35,000.00 |
| July 5, 1884 | 20,000.00 |
| August 5, 1886 | 10,000.00 |
| August 11, 1888 | 20,400.00 |
| September 19, 1890 | 20,000.00 |
| July 13, 1892 | 15,000.00 |
| August 18, 1894 | 15,000.00 |

| By act of— | |
|---|---|
| June 3, 1896 | $75,000.00 |
| March 3, 1899 | 150,000.00 |
| June 6, 1900 | 185,350.00 |
| March 3, 1901 | 255,000.00 |
| Sundry civil act of June 28, 1902 | 215,000.00 |
| Sundry civil act of March 3, 1903 | 204,480.00 |
| Total | 1,547,230.00 |
| Amount received from sale of property | 1.00 |
| Total | 1,547,231.00 |
| Expended to June 30, 1904 | 1,245,562.32 |
| Balance unexpended June 30, 1904 | 301,668.68 |

*List of contracts in force during fiscal year ending June 30, 1904, Calumet Harbor, Illinois.*

| Name and address of contractor. | Nature of contract. | Date. | To expire. | Closed. |
|---|---|---|---|---|
| The Lydon & Drews Co., Chicago, Ill. | Dredging | Mar. 19, 1902 | Sept. 1, 1903 | Nov. 20, 1903 |
| Gillen & Gillen, Racine, Wis. | Breakwater construction | Nov. 12, 1902 | Dec. 31, 1903 | |

Both of above mentioned contracts were extended for a reasonable time.

COMMERCIAL STATISTICS.

Amount of revenue collected at nearest port of entry (Chicago) during fiscal year 1904 ........ $8,141,662.07

*Arrivals and clearances of vessels at Calumet Harbor.*

| | Arrivals. | | Clearances. | |
|---|---|---|---|---|
| | Number. | Tons. | Number. | Tons. |
| Steam | 626 | 1,572,488 | 750 | [illegible] |
| Sail | 251 | 308,169 | 264 | [illegible] |
| Total | 877 | [illegible] | [illegible] | [illegible] |

*Receipts and shipments by lake at South Chicago, Ill., during calendar year 1903.*

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coal | [illegible] | Wheat | [illegible] |
| Iron ore | [illegible] | Corn | [illegible] |
| Lumber | [illegible] | Oats | [illegible] |
| Shingles | [illegible] | Rye | [illegible] |
| Stone | [illegible] | Barley | [illegible] |
| [illegible] | [illegible] | Flour | [illegible] |
| [illegible] | [illegible] | Grass seeds | [illegible] |
| [illegible] | [illegible] | Mill stuffs | [illegible] |
| [illegible] | [illegible] | Oil cake | [illegible] |
| [illegible] | [illegible] | Glucose | [illegible] |
| [illegible] | [illegible] | Oil | [illegible] |
| [illegible] | [illegible] | Manufactured iron | [illegible] |
| [illegible] | [illegible] | Unclassified | [illegible] |
| Total | [illegible] | Total | [illegible] |

*Comparison of receipts and shipments by lake at South Chicago, Ill., for calendar years 1894 to 1903, inclusive.*

| Year. | Tons. | Year. | Tons. |
|---|---|---|---|
| 1894 | 1,436,897 | 1899 | 3,229,874 |
| 1895 | 2,857,750 | 1900 | 3,783,674 |
| 1896 | 2,973,724 | 1901 | 3,995,277 |
| 1897 | 8,498,218 | 1902 | 4,454,428 |
| 1898 | 4,117,526 | 1903 | 4,742,225 |

### REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

United States Engineer Office,
*Chicago, Ill., July 5, 1904.*

Colonel: I have the honor to submit the following report on operations in Calumet Harbor, Illinois, during the fiscal year ending June 30, 1904.

At the beginning of the year there were two contracts in force for the improvement of this harbor, viz:

1. With the Lydon & Drews Company, of Chicago, Ill., dated March 16, 1902, for deepening the area sheltered by the breakwater and the channel between the harbor piers, and
2. With Messrs. Gillen & Gillen, of Racine, Wis., dated November 12, 1902, for the extension of the breakwater a distance of 2,500 feet.

A special agreement, authorized by the Chief of Engineers in a letter dated May 2, 1903, was also in force with the last-named firm. This was for repairing the damage done to the breakwater by the steamer *Matoa* on December 9, 1902.

### WORK DONE DURING THE YEAR.

Under the first of these contracts work was continued until the 16th of November, 1903, when it was completed, the last payment made, and the contract closed. The total amount of material removed under the contract was 1,440,734 cubic yards, of which 207,523 cubic yards were dredged during the fiscal year.

Work under the second contract was begun with the forming of the stone foundation for the first, the angle crib. This crib was sunk in place and filled with stone on the 7th of July, 1903. The prevalence of unusually unfavorable weather resulted in the sinking of only 9 cribs in all up to December 9, when operations were closed for the winter. Work for the season of 1904 was resumed on April 15, and at the close of the year the following work had been accomplished:

The stone foundation was practically completed for a distance of 1,600 feet; fifteen cribs, each 30 feet wide, 24 courses high, and 100 feet long, were sunk in place and filled with stone. The superstructure, including decking, was completed over the first 5 cribs sunk and was built in part about 500 feet farther. Only about 200 linear feet of the ice guard was placed, owing to the prevailing high stage of the lake level.

The contract was to have expired on December 31, 1903, but owing to the exceptionally unfavorable weather during the greater part of the year, together with strikes and other obstructive conditions, the contractors requested an extension of time, which was granted by the Chief of Engineers, on October 29, 1903, for "a reasonable time."

The work under the special agreement, the repair of the damaged part of the breakwater, was completed and paid for on September 15, 1903. The total cost was $7,014.19.

### CONDITION OF THE WORKS ON JUNE 30, 1904.

The north pier is in serviceable condition.

The south pier: The superstructure over the inner or westerly 1,200 linear feet of this pier is in a state of decay, especially the easterly 300 feet of this stretch, and requires rebuilding at an early date. The present superstructure was built in 1892. The balance of the pier is in fair condition.

The breakwater is in good condition.

[illegible] and to rebuild the superstructure [illegible] the coming year. [illegible]

G. A. M. LILIENCRANTZ,
Assistant Engineer.

[illegible] ILLINOIS AND INDIANA.

[illegible] M. Deming & Ward Dredging [illegible] dredging [illegible] and [illegible]

The lake trade of Calumet River and Harbor for the calendar year 1903 was about 300,000 tons greater than in the previous year. The growth of this trade has been almost continuous since 1894, as is shown in the tabular statement attached to my report on Calumet Harbor herewith. It is very far from having reached its limit. A number of large additional enterprises have planned to locate upon the river with the hope and belief that the obstructions to navigation will be removed. It is much to be desired that this be done without unnecessary delay. The amount which I recommend below as the "amount that can be profitably expended in the fiscal year ending June 30, 1906," is the amount required to complete the rock excavation. It is suggested that the place is of sufficient national importance to justify placing it under the continuous contract system.

It is proposed to apply the funds now available, and those asked for for the year ending June 30, 1906, to continuing the enlargement of the channel progressively up stream.

## *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $82,361.22 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | | 43,000.00 |
| | | 125,361.22 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | | 22,910.58 |
| July 1, 1904, balance unexpended | | 102,250.64 |
| July 1, 1904, amount covered by uncompleted contracts | | 47,725.36 |
| Amount (estimated) required for completion of existing project | | 423,822.50 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $300,000.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 310,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

---

### APPROPRIATIONS.

| By act of— | |
|---|---|
| July 5, 1884 | $50,000.00 |
| August 5, 1886 | 30,000.00 |
| August 11, 1886 | 50,000.00 |
| September 19, 1890 | 50,000.00 |
| July 13, 1892 | 75,000.00 |
| August 18, 1894 | 45,000.00 |
| June 3, 1896 | 50,000.00 |
| March 3, 1899 | 60,000.00 |
| June 13, 1902 | 75,000.00 |
| April 28, 1904 | 43,000.00 |
| Total | 528,000.00 |

| | |
|---|---|
| Amount expended to June 30, 1904 | $425,549.36 |
| Allotted to Board of Engineers for Rivers and Harbors | 200.00 |
| Balance unexpended June 30, 1904 | 102,250.64 |

### LIST OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1904.

### *Calumet River, Illinois and Indiana.*

| Name and address of contractor. | Nature of contract. | Date. | To expire. |
|---|---|---|---|
| Griffiths, McDermott and Watt Dredging Company, Chicago. | Dredging..... | Feb. 20, 1903 | Nine months after opening of navigation in 1903. |

Contract extended for a reasonable time.

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### REPORT OF MR. G. A. M. LILJENCRANTZ, ASSISTANT ENGINEER.

United States Engineer Office,
*Chicago, Ill., July 6, 1904.*

Colonel: I have the honor to submit the following report on operations in Calumet River, Illinois, during the fiscal year ending June 30, 1904:

There was one contract in force during the year for work of improvement of this river, viz: With the Griffiths, McDermott & Watt Dredging Company, of Chicago, Ill., dated February 20, 1903, for deepening the channel, for a width of 200 feet, between One hundred and sixth and One hundred and tenth streets to a depth of 20 feet, and from One hundred and eighteenth street southwardly, as far as available funds will permit, to a depth of 14 feet.

#### WORK DONE DURING THE YEAR.

The hydraulic dredge, which was expected to be employed on this work, was very extensively remodeled and refitted for that purpose, but its completion was seriously delayed, it was claimed, by strikes and other causes, and was not brought to the field of operations until in August, when an attempt was made to begin work, but was unsuccessful. Further attempts were made in September and October, but it was found that some parts of the machine, more particularly the revolving cutters, were not suitable for the kind of material to be removed, and on the 10th of the latter month operations were discontinued and the crew disbanded.

Actual and effective work was not begun until the 2d of November, 1903, when two dipper dredges were placed at One hundred and sixth street and proceeded with the dredging of the 20-foot channel until the cold weather compelled the cessation of operations for the winter, on December 14. A channel 1,450 feet in length was completed, accepted, and paid for. It contained 39,880 cubic yards. Meantime, the hydraulic dredge had again been fitted out and was employed in redredging the channel between One hundred and seventeenth and One hundred and eighteenth streets, which, during the very heavy spring freshets, had shoaled up to a considerable extent. This dredge removed, thus, 10,182 cubic yards.

Operations for the season of 1904 were resumed on April 4 with the two dipper dredges, and at the close of that month the 20-foot channel to One hundred and tenth street was completed by the removal of, in all, 84,[illegible] cubic yards.

The dipper dredges were next moved to near One hundred and fourteenth street to redredge the channel that had seriously shoaled up during the spring. Only one of the dredges, however, remained at work after May 5. This channel, dredged to a depth of 14 feet, was completed for a distance of [illegible] feet and contained 45,[illegible] cubic yards of material. The work done in June has not yet been estimated. There have been removed and paid for, under the contract, in all, [illegible] cubic yards, at a cost of $21,779.50.

It was expected that the hydraulic dredge, which has again been remodeled, would be placed on the work once more, but it was finally taken to Chicago to work at the filling of the "Grant Park."

The contract was to have expired on December 31, 1903, but on request from the contractors an extension of time was granted by the Chief of Engineers under date of December 21, 1903, "for a reasonable time," with the provision that the cost of inspection during the time of extension shall be paid by the contractors. This has been done since the resumption of work in April last.

On the [illegible] of June last, the information was received from the Department that the Secretary of War had allotted the sum of $[illegible] for the purpose of [illegible] the 20-foot channel between the mouth of the river and One hundred and sixth street.

A project for this work was submitted to the Chief of Engineers on that day and was approved on the 11th following. Specifications were prepared and submitted to the Department for approval on June 18, and they were approved on the 23d. Proposals were advertised for under date of June 25, 1904, and are to be opened on the 26th instant.

In accordance with provisions in the river and harbor act of June 13, 1902, and on request from the property owners along the Calumet and Grand Calumet rivers, above "The Forks," the Chief of Engineers, on February 16, 1904, authorized the acceptance of deeds from the said property owners for a right of way 200 feet wide from "The Forks" to one-half mile east of Hammond, Ind.; such conveyance and release from claim for damages to be in conformity to the channel lines suggested, and shown on the map of the survey of 1885, and revised and corrected in 1887. Blue-prints of the said map were accordingly furnished the property owners through Mr. Leslie Carter, and I have been informed that the work of preparing the conveyances and releases is in progress.

### WORK PROPOSED FOR THE ENSUING YEAR.

It is proposed to continue and complete the existing contract during the ensuing year, and to enter into a new contract for dredging north of One hundred and sixth street if satisfactory proposals for this work are received.

I am, Colonel, very respectfully, your obedient servant,

G. A. M. Liljencrantz,
*Assistant Engineer.*

Col. O. H. Ernst,
*Corps of Engineers.*

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## K K 5.

## SURVEY OF ILLINOIS AND DES PLAINES RIVERS, ILLINOIS; FOR WATERWAY FROM LOCKPORT, ILLINOIS, TO ST. LOUIS, MISSOURI.

The survey of the Illinois and Des Plaines rivers, conducted under the Board of Engineer officers appointed by Special Orders, No. 19, Headquarters, Corps of Engineers, July 5, 1902, made good progress during the year. The field work was completed and the construction of the maps was well advanced.

Lieut. Col. Chas. J. Allen was retired from active service January 8, 1904, and was replaced on the Board by Maj. Jas. L. Lusk, Corps of Engineers, by virtue of Special Orders, No. 17, dated War Department, Office of the Chief of Engineers, April 26, 1904.

For details of the work see report of J. W. Woermann, junior engineer, hereto appended:

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $127,460.85 |
| June 30, 1904, amount expended during fiscal year for works of improvement | 84,296.68 |
| July 1, 1904, balance unexpended | 43,164.17 |

### APPROPRIATIONS.

| | |
|---|---|
| June 13, 1902, allotment | $175,000 |

### REPORT OF MR. J. W. WOERMANN, JUNIOR ENGINEER.

United States Engineer Office,
*Peoria, Ill., July 13, 1904.*

Colonel: I have the honor to submit the following report of the work accomplished during the fiscal year ending June 30, 1904, on the survey of the Illinois and Des Plaines rivers:

At the beginning of the fiscal year the quarter boats *Margaret* and *No. 1* were moored at Peoria, Ill., where they were being held until the stage of water should fall sufficiently to enable the force to return downstream and survey the large area, which, during our first trip up the river, had been necessarily omitted on account of its flooded condition.

In order that this might be done without interfering with the progress of the triangulation party, the steamer *Eva Alma* was chartered to handle the quarter boat *Margaret*, with the main party on board, leaving the steamer *Pearl* free to proceed upstream with the secondary triangulation party.

During the first part of July, in addition to the work on the maps and on triangulation and precise levels, two parties were engaged in taking topography and one in running Wye levels between Peoria and Chillicothe, on such territory as still remained above high water.

On July 13 the steamer *Eva Alma* and barge left Grafton, and on July 15 arrived at Peoria. The stores and equipment were divided between the two quarter boats in accordance with the size of the respective parties. On July 16 the *Eva Alma* started for Valley City with the quarter boat *Margaret* and arrived there at 9 a. m. July 18. Two additional parties were immediately placed in the field, and two more on July 20. At the close of the month the following organization was operating from the quarter boat *Margaret:* One tertiary triangulation party, seven topographical parties, and one Wye level party. As the soundings had been completed to Naples during the preceding March, it was not necessary for the hydrographical party to resume work until August 7.

The dense foliage, the large amount of underbrush, and the numerous sloughs and lakes, combined with the "breaking in" of a large number of new men, made the taking of topography a slow process between Montezuma and Valley City.

From Valley City to the Lagrange dam the field work progressed more favorably. Above the dam, however, the country is low and swampy and covered with timber, brush, and vines. The territory between the Lagrange dam and Beardstown was the most difficult to survey which had so far been encountered on this work. The mosquitoes were bad and malaria became more prevalent. The heavy rain on August 27 aggravated these conditions, and for a time made wading the order of the day.

The last car of lumber for the two new quarter boats was received at Columbiana on July 8, and was immediately transferred to Kampsville. This lumber had been ordered during the preceding January, but on account of the high water and other reasons had been greatly delayed, to the detriment of the work. As stated in my last annual report, both hulls had been built and launched, and the framework and siding erected on the double-decked quarter boat, which had been named the *Sangamon*. Asst. Engineer C. V. Brainard then proceeded to complete the *Sangamon* as fast as the force at his command would permit, in accordance with the plans which were submitted at that time.

This work was not completed, however, until September 10, on which date the *Sangamon* was towed by the steamer *Pearl* from Kampsville to Beardstown, where the main party was then located. The overcrowded condition on the *Margaret* and *Eva Alma* was then relieved by transferring part of the force to the *Sangamon*, and two additional topographical parties were placed in the field, making a total of eight parties taking topography.

During the month of September the field work was greatly retarded by frequent rains, which resulted in a rise in the river ranging from 2 to 3 feet. A large portion of the lower lands were again inundated. In the Sangamon Valley alone about 20 square miles were rendered inaccessible. As a result of these conditions it again became necessary to omit a portion of the territory with a view to securing it later on should conditions permit. Taken as a whole, the outlook seemed very discouraging, and it was obvious that a record for economy was a physical impossibility.

Upon arriving at Havana with our quarter boats, I found there was still so much territory under water between that point and Kingston Mines that our whole force could not be used to the best advantage in that vicinity. Inasmuch as the secondary triangulation had now been completed to Lasalle, and the country between Lasalle and Chillicothe was all dry except the district around Lake Senachwine, and a few smaller tracts farther south, it seemed advisable to divide the force and handle the survey parties with two steamers instead of one.

Fortunately I was able to make arrangements with the owner of the *City of Peoria* to tow the quarter boat *Sangamon* from Havana to Spring Valley between Saturday night and Monday morning, so that the field force would lose no time. We left Havana early on Sunday morning, October 25, and arrived at Spring Valley shortly after midnight. The distance traveled was about 100 miles and was covered without any incident of note.

Mr. Henry Fox was placed in charge of the quarter boat *Sangamon*, and his party taken off the secondary triangulation work temporarily and placed on tertiary work. The field force, as it began work at Spring Valley on Monday morning, October 26, consisted of 1 tertiary triangulation party, 1 sounding party, 3 topographical parties, and 1 Wye level party.

As explained under the section headed "Borings," the steamer *Fox* was required for that branch of the work, and it therefore became necessary to hire another steamboat to accompany the quarter boat *Sangamon*. The steamer *Mary* and one coal barge were chartered for this purpose and began work on November 3. The compensation was $200 per month, the same as for the *Eva Alma*, the crew being furnished by the United States in each case.

An additional topographical party was placed in the field on November 9, using the old Seelig & Kandler transit, which had been used by the secondary triangulation party in cutting lines between stations. On November 12 the boring party began work, as detailed in the section entitled "Borings," and on November 16 a third Wye level party was placed in the field, making a total of 136 men engaged on the work, distributed as follows:

| | |
|---|---|
| 1 precise level party | 5 |
| 2 tertiary triangulation parties, 6 each | 12 |
| 8 topographical parties, 6 each | 48 |
| 2 hydrographical parties, 8 each | 16 |
| 3 Wye level parties, 4 each | 12 |
| 1 boring party | 5 |
| 3 steamboat crews | 14 |
| Draftsmen and clerks | 14 |
| Cooks and waiters | 10 |
| Total | 136 |

In order that the towboats might be utilized as long as possible in taking the parties to and from work, the steamers *Fox*, *Mary*, and *Eva Alma*, together with the boring boat *La Salle*, were sheathed along the water line with oak boards in order to protect their hulls from running ice. The closing of the river by ice on December 11, however, necessitated laying up all three steamboats for the winter. The quarter boats *Margaret*, *Sangamon*, and *La Salle* were utilized throughout the month, however, in boarding and quartering the survey parties while engaged on field work within reach of these points.

On December 17 Mr. John H. Best, who had been in charge of test borings, took a topographical party into the field, and on December 19 Mr. T. C. Thogerson, who had completed the tertiary triangulation, as described later, began taking topography, making a total of ten topographical parties.

On December 29 the office furniture of the quarter boat *Sangamon* was hauled from Lacon to Peoria, and the drafting force on the *Sangamon* transferred to the Peoria office. The supplies on hand were shipped to Pekin for use on the quarter boat *Margaret*, and the *Sangamon* closed for the winter, leaving one watchman in charge.

The field force was now directed to the work of surveying the large amount of territory which had been inundated ever since the survey began, as the only practicable method of securing this data within the time allowed for the survey was by doing the work on the ice. The parties were therefore distributed throughout the valley from Grafton to Lasalle, a distance of 225 miles.

The necessity of planning and directing by mail the work of 12 parties engaged on such widely scattered tracts was a difficult task. Tracings were made from the field sheets showing the limits of each tract remaining to be surveyed, which were sent to the various parties in the field from time to time to guide them in securing the desired data. A table was prepared to accompany each tracing, giving the azimuths and elevations which were required in beginning each detached survey and in connecting the same with the old work. A total of 80 such tracings were prepared during the winter, covering an area of about 90 square miles.

The sounding of the river was completed on January 30, except 11 ranges at the upper free bridge at Peoria, where the velocity of the current kept the river partly open. These 11 ranges were sounded and platted during the past month. During the remainder of the winter the hydrographical parties were engaged in sounding the Sangamon River and various lakes which it was impracticable to sound previous to freezing weather.

The 12 parties engaged on topography and hydrography completed the work assigned to them during the latter part of February, just as the ice began to break up. Two observers and 2 recorders were transferred to secondary triangulation and borings, 10 observers and 5 recorders to the Peoria office to work on the maps, and the other members of the parties were laid off.

On April 26 and 27 the quarter boats *Margaret* and *Sangamon* were taken from their winter quarters at Pekin and Lacon, respectively, and towed to Beardstown, Ill., by the steamer *Mary* under special agreement. Both quarter boats, with their kitchen and dining room equipment, were transferred to Asst. Engineer C. V. Brainard.

The character and scope of the various branches of the Survey, limits of error allowed, and descriptions of targets and permanent monuments were given in my last annual report. Further details in regard to the work executed during the past year are given under their respective headings. A summary of that portion of the field and office work which has been kept in tabulated form is as follows:

| | Year ending June 30— | | Total to June 30, 1904. |
|---|---|---|---|
| | 1903. | 1904. | |
| SECONDARY TRIANGULATION. | | | |
| Number of stations established | 64 | 78 | 137 |
| Number of stations occupied | 61 | 83 | 144 |
| Number of angles observed | 226 | 266 | 492 |
| Number of triangles adjusted and computed | 63 | 106 | 169 |
| Number of stations, coordinates computed | 61 | 61 | 122 |
| Number of stations, latitude and longitude computed | .......... | 106 | 106 |
| Permanent monuments set | 53 | 67 | 120 |
| Prominent buildings located | 25 | 149 | 174 |
| Number of towers erected | 14 | 44 | 58 |
| TERTIARY TRIANGULATION. | | | |
| Number of stations established | 249 | 820 | 1,069 |
| Number of stations occupied | 251 | 833 | 1,084 |
| Number of angles observed | 729 | 2,452 | 3,181 |
| Number of triangles adjusted and computed | 253 | 783 | 1,036 |
| Number of stations, coordinates computed | 243 | 830 | 1,073 |
| Number of base lines measured | 16 | 12 | 28 |
| PRECISE LEVELS. | | | |
| Miles of duplicate levels | 137.9 | 205.5 | 343.4 |
| Miles of single line, rerunning, etc | 52.3 | 57.2 | 109.5 |
| Total miles of single line | 328.1 | 468.2 | 796.3 |
| Permanent bench marks established | 44 | 95 | 139 |
| Temporary bench marks established | 205 | 292 | 497 |
| Other bench marks determined | .......... | 82 | 82 |
| TOPOGRAPHY. | | | |
| Number of stations occupied | 6,905 | 10,814 | 17,719 |
| Square miles of topography taken | 290.1 | 392.6 | 682.7 |
| Section corners located | 208 | 160 | 368 |
| High-water marks determined | 103 | 56 | 159 |
| HYDROGRAPHY. | | | |
| Number of stations occupied | 1,373 | 4,588 | 5,961 |
| Sounding ranges established and located | 1,110 | 4,395 | 5,505 |
| Number of ranges sounded | 1,054 | 4,451 | 5,505 |
| HYPSOMETRY. | | | |
| Miles of duplicate levels | 165.5 | 116.9 | 282.4 |
| Miles of single line | 256.2 | 663.4 | 919.6 |
| Total miles of single line | 587.2 | 897.2 | 1,484.4 |
| Bench marks established | 258 | 326 | 584 |
| Old bench marks determined | .......... | 64 | 64 |
| Water gauges determined | 20 | 125 | 145 |
| Sounding pegs determined | 520 | 1,167 | 1,687 |
| BORINGS. | | | |
| Number of holes drilled | .......... | 509 | 509 |
| Total depth drilled below river bottom | .......... | 12,059 | 12,059 |
| Average depth drilled below river bottom | .......... | 23.7 | 23.7 |
| Average depth drilled below low water | .......... | 33.2 | 33.2 |
| FIELD MAPS. | | | |
| Triangulation stations platted | 270 | 800 | 1,070 |
| Ranges of soundings platted | 1,108 | 4,397 | 5,505 |
| Square miles of topography platted | 290 | 392.7 | 682.7 |
| Square miles of contours drawn | 240 | 442.7 | 682.7 |
| Square miles of contours checked | 228.8 | 453.9 | 682.7 |

| | Year ending June 30— | | Total to June 30, 1904. |
|---|---|---|---|
| | 1903. | 1904. | |
| FINAL MAPS. | | | |
| Triangulation stations platted | 92 | 994 | 1,086 |
| Square miles of topography transferred | 44.5 | 638.2 | 682.7 |
| Square miles of topography inked in | 23 | 659.7 | 682.7 |
| Lines of soundings platted | | 5,505 | 5,505 |
| Lines of soundings inked in | | 4,835 | 4,835 |

*Secondary triangulation.*—As previously stated, Mr. Henry Fox was left at Peoria on July 16, with the steamer *Pearl* and quarter boat *No. 1*, to continue the secondary triangulation upstream, independent of the main party. On July 20, in accordance with the request of Assistant Engineer Brainard, the steamer *Pearl* was returned to Kampsville and the steamer *Fox* taken in exchange. As soon as the *Fox* returned to Peoria the quarter boat was towed to Chillicothe, and the work proceeded without interruption until the party reached Lasalle. Mr. C. V. Brainard then found that the quarter boat *No. 1* was needed on his own work, and the tools and equipment were accordingly removed, and the quarter boat returned to him at Beardstown, Ill., by the steamer *Fox*, on October 20.

Arrangements were then made to carry on the secondary triangulation entirely by land by having the party board at the nearest towns and by using teams and the electric line for transportation. On October 25, for reasons previously explained, Mr. Fox was placed in charge of the quarter boat *Sangamon* and his party temporarily transferred to tertiary triangulation work.

On December 28 the party resumed work on the secondary triangulation at Utica, where that branch of the work had been suspended temporarily on October 24. Work was then carried on without interruption until the field work was completed on May 12, 1904.

The atmospheric conditions were bad for reading angles during a large part of the winter. During March and April the progress of the party was still further retarded by rain and snow, high winds, muddy roads, and the high stage of the river. On account of the nature of the valley, and the high price at which the timber was held, it was found necessary to erect 44 towers. These were built of local timber and were left standing. Their usual height ranged from 20 to 30 feet, with the single exception of a 50-foot tower erected inside of an electric-light tower at Peoria. Heliotropes were resorted to in securing a large part of the angles.

On May 11 our system was connected with the sanitary district triangulation near Lemont, about 12 miles from △ Chicago west base. This system connects with the Chicago base line of the survey of the Great Lakes, and the intervening angles were carefully determined by the sanitary district in 1894 within the usual secondary limits.

During the fiscal year four secondary base lines were measured as follows:

| Location. | Names of stations. | Measured length. | Computed length. |
|---|---|---|---|
| | | *Feet.* | *Feet.* |
| Henry | △ Crow Creek to △ Henry | 13,803.46 | 13,803.40 |
| Lasalle | △ Carbon to △ Oglesby | 5,384.67 | 5,383.89 |
| Marseilles | △ Marseilles to △ Hobert | 14,358.91 | 14,358.45 |
| Elgin, Joliet and Eastern bridge | △ Dell Abbey to △ Felix | 14,099.36 | 14,099.82 |

Observations were made for azimuth, latitude, and time at fifteen points, viz, Peoria, Chillicothe, Lacon, Henry, Hennepin, Spring Valley, Peru, Utica, Ottawa, Marseilles, Seneca, Morris, Channahon, Rockdale, and Lemont.

On May 12 the secondary triangulation party was disbanded, and Messrs. Fox and Thogerson reported at the Peoria office to complete the reduction of the field notes and begin the computation of geodetic positions.

A copy was made of all the sanitary district triangulation data from Chicago to Lockport, and the triangles recomputed. The latitude and longitude of twenty-four of these stations was recomputed in order to make them agree with the readjusted coordinates of the primary triangulation of the United States Lake Survey of 1882, referred to the present United States standard datum, which is defined in terms of the position of the △ Meades ranch, Kansas. This computation is included in the general tabulation with the work relating to the secondary triangulation of the Illinois and Des Plaines rivers.

Up to the end of the fiscal year, tables were prepared for platting the parallels and meridians from twenty-three stations of the sanitary district triangulation and forty-three stations of the triangulation of the Illinois and Des Plaines rivers. These tables conform to those given in the Report of the Chief of Engineers for 1902, pages 2841 to 2852.

*Tertiary triangulation.*—The order and conditions under which this work was carried on has been detailed previously, but a few additional points are worthy of mention.

Above Havana there was no dry ground available for transit stations on either side of the river for about 4 miles, and it became necessary to erect nine platforms or low towers in the water in order to carry the tertiary triangulation past that section. The same condition was encountered between Chillicothe and Springbay in December.

On December 18, Mr. T. C. Thagerson, who had been working upstream on tertiary triangulation, connected with the tertiary base line just south of Rome, and on December 23, Mr. Henry Fox, who had been working downstream, connected with the same base, thereby completing the tertiary triangulation of the Illinois River from Grafton to Lasalle.

Short sections of tertiary triangulation were also established at Lasalle, Ottawa, Marseilles, Seneca, Elgin Joliet and Eastern Railroad bridge, and at Rockdale, to assist in connecting the topography taken by Mr. Jas. A. Seddon, in 1899–1900, with the secondary triangulation system of this survey.

*Precise levels.*—At the beginning of the fiscal year the precise level party was located near the north line of Mason County, about 15 miles northeast of Havana. From this point the party followed the highway along the east side of Spring Lake to a point west of Stoehr's station on the Chicago, Peoria and St. Louis Railway; thence east along the highway to this station; thence along this railroad to the Peoria and Pekin Union Railway bridge at Peoria. At this bridge the line of levels, which hitherto had followed the east side of the river, was carried across to the west side. From Peoria to Bureau the line in general followed the Peoria branch of the Chicago, Rock Island and Pacific Railway, occasional deviations being made when a parallel highway presented better facilities for progress. Eastward from Bureau the party followed the Chicago, Rock Island and Pacific Railway to Peru; thence through Peru and Lasalle via the Chicago, Burlington and Quincy Railway and the towpath of the Illinois and Michigan Canal.

From Lasalle to Channahon the line followed the highway along the north bank of the river known as the River road, excepting for short distances at Marseilles, Morris, and Seneca, where the canal towpath was used. From Channahon to Joliet the River road was followed, excepting for a few miles to the east and northeast of Channahon, where the line was run through the fields at the foot of the bluffs. At Joliet the levels were carried across to the east side of the Des Plaines River; thence along the towpath of the Illinois and Michigan Canal to Lockport; thence along the east bank of the Chicago Drainage Canal to Willow Springs; thence along the towpath of the Illinois and Michigan Canal to Bridgeport, the northern terminus of the canal. Thence along the east side of the South Branch of the Chicago River to Twenty-third street; thence east to Michigan avenue; thence north to the waterworks on Chicago avenue, where on June 27 the party connected with three of the precise bench marks established by the Mississippi River Commission in 1883, thereby completing the line of precise levels from Grafton to Chicago.

The following comments in regard to the progress of this branch of the survey are quoted from Mr. Fred Morley, junior engineer in charge of the precise levels.

"The winter of 1903–4 was an unusually rigorous one, even for a northern latitude, and while the work was continued during the winter months, it was carried on only against great odds and almost insurmountable obstacles. Deep frozen ground, intense cold, strong winds, and heavy snowfalls necessarily retarded progress.

"Approaching Chicago and the lake through the valley of the Des Plaines River in the spring of the year, * * * nearly every day, and sometimes for a week at a time, the wind has drawn through the valley with gale-like intensity making leveling absolutely impossible.

"The linear progress of the main line of levels has been considerably retarded above Peru by the great number of benches of former surveys connected with, viz, eighty-two, or nearly as many as the whole number of permanent benches established during the year.

"The 6 to 8 miles of levels through the city of Chicago have also been run under increased difficulties incident to the disturbing influences of the traffic and smoke of a large city."

*Topography.*—During the year the wire interval was determined for five additional transits, and a set of three stadia boards graduated for each instrument.

Although the long periods of severe cold weather during the past winter made surveying hard and disagreeable, the prospects for securing all the topography were always brightest during such weather and most discouraging when a warm spell prevailed. During the first nineteen days of January the temperature was frequently above the freezing point, as a result of which the ice became rotten, and the men broke through frequently while at work on the various sloughs and swamps. In one instance a transit was damaged, but not seriously enough to put it out of commission.

The excessive rain on January 19 and 20 throughout the Illinois River Valley resulted in a rise of 5 to 10 feet throughout the entire length of the river. In the river proper the old ice raised with the water, and for that reason the soundings there were not interfered with. In the bottoms, however, where all of the topographical parties were at work, the water flowed over the top of the ice, resulting in a suspension of work by twelve field parties. All of the parties were instructed to remain at their various quarters, in the hope that a cold wave would follow speedily and again form a crust of ice upon which to resume work. By January 26, the new layer of ice had sufficient thickness to enable most of the parties to resume work. Three of them, however, were unable to do so until January 29.

As a result of the freshet described above, all of the parties during the remainder of the winter worked under peculiar and very unusual conditions. In order to obtain readings on the surface of the ground it was necessary not only to cut through the top layer of ice, but also a second layer 4 to 6 feet below the upper layer, varying in thickness from 6 to 12 inches. In order to secure readings under these conditions each party was provided with ice chisels 8 to 10 feet long for the purpose of cutting holes through this lower layer of ice. This made the field work slower and more expensive than before, but it was fortunate that we were able to secure the data, even under such adverse conditions.

When the topographical parties were disbanded, Mr. H. D. Harting and his recorder were detailed to draw the section lines on all the field sheets. The bearings of all section lines, and the distances between corners were copied from the plats of the original land survey. Taking as a basis the 340 section corners which had been located and platted on this survey, 412 additional corners were platted by using the original measurements above referred to. Above Peoria it was found there had been insufficient locations in the field to plat the lines accurately, and on June 6 Mr. Harting was sent out with a transit party to locate additional section corners wherever they were needed. During the month of June 28 such corners were located between Peoria and Lasalle. While engaged upon this work he has also secured additional data, wherever it was needed, to complete fence lines, ditches, roads, houses, etc.

On June 16 Mr. W. D. Hudson, survey man, was sent into the field to secure the names of all landowners between Grafton and Beardstown, as it was usually not practicable for the topographical parties to secure this data during the progress of the regular survey. Up to the end of the month 336 such names had been secured.

*Hydrography.*—The two regular sounding parties were in charge of Messrs. F. B. Duis and Edmund Polk. During the winter, however, seven of the topographical parties were employed during a portion of their time in sounding 180 of the larger lakes and sloughs which it was impracticable to sound previous to freezing weather.

The portion of the river known as Lake Peoria is about 20 miles long and from 1 to 2 miles wide. On account of its width and the character of the east shore this section was sounded through the ice.

After the completion of the field work the low-water profile of the Illinois River for the year 1901 was platted from Copperas Creek lock to Lasalle, and the soundings on 1,729 ranges reduced to this basis.

*Hypsometry.*—Wye levels were run continuously by Mr. A. J. Meidroth from July 18 to the date of his resignation on March 9. His work was carried on rapidly and carefully. The work done by two other levelers was not satisfactory, however, and their services were dispensed with. A large part of their work was rerun by Messrs. A. W. Sargent and H. R. Howes. Upon the completion of their work, these parties were laid off, on December 14 and 23, respectively, excepting Mr. Sargent, who was retained on map work.

As the water was rising rapidly at the time of Mr. Meidroth's resignation, his party was laid off, and the work of connecting with the old bench marks and gauges between Lasalle and Lockport was not resumed until after the high water. This work was again taken up by Mr. E. F. Sessinghaus on May 2 and completed on June 4.

The descriptions and elevations of 354 bench marks were compiled and copied in separate notebooks, and 284 of them platted. A table has been prepared showing the location and elevation of all gauges between Grafton and Lockport.

*Test borings.*—After the completion of the quarter boat *Sangamon*, on September 10, Mr. C. V. Brainard, assistant engineer, concentrated the work of his carpenters on the quarter boat *La Salle*, the hull of which was already completed. This boat was originally designed for a quarter boat for survey parties, but on account of the delay in the delivery of the lumber, the quarter boat *Margaret* was purchased from the Missouri River Commission, and the plans for the *La Salle* were redrawn, so as to adapt the same to making borings. On this account it has been referred to more frequently as the boring boat.

A well was cut through the rake at one end through which to operate the boring machine. A yellow pine spud 10 inches by 10 inches by 32 feet was provided at each corner. In addition to an office and the usual living quarters, a blacksmith shop was arranged at one corner of the boat, furnished with the necessary tools.

The boring machine purchased is known as the "Pierce Test Boring Rig No. 80," for a description of which see the manufacturer's catalogue. On account of the loss in shipment of one box of boring machinery, and the refusal of the company to replace it at once, a number of make-shifts had to be resorted to and the equipment was not completed until November 12. The boat was then towed from Beardstown to Grafton and the work of making test borings begun on November 14, under the direction of Mr. John H. Best.

The method of operating the machine is described by Mr. Best as follows: "Two-inch casing of extra strong wrought-iron pipe, in 5-foot lengths, was driven into the bed of the river with a 200-pound driving ram, having a maximum fall of 8 feet. The drill consists of light ¾-inch wrought-iron pipe with hydraulic crosshead and with hose attached to a steam deck pump. This drill was churned in the casing, and all the material that would pass between the interior of the casing and the exterior of the drill rod was brought up with the overflow, from which samples were caught in pails. In general, the drill was kept 5 feet in advance of the casing, and any change in material was noted as the drill entered it. Borings were put down in or near the channel to a depth of about 30 feet below low water and at intervals of one-half mile, or more frequently if there was a marked change in the character or arrangement of the material."

The work of making borings proceeded steadily until on December 11 the hull of the steamer *Fox* was punctured by running ice and, as there was no immediate prospect of more moderate weather, the boring operations were suspended on the day following and the fleet laid up for the winter at Pearl, Ill.

From this time until March 12 Mr. Best was engaged on field work, as previously described. The engines and other parts of the equipment were then overhauled previous to beginning another season's work, and on March 21 boring operations were resumed. For a time the high stage of the river interfered seriously with their work, however, as the water was so high and so swift that the four spuds would not hold the boring boat in mid stream. During this period the party operated close to the banks, alternating from one side to the other, placing the holes about 100 feet from each bank.

The work proceeded steadily until June 18, when the borings were completed to Peru, Ill., and the party then returned downstream to make additional borings at points in the river between Havana and Pearl, where, during the high water, it was found impossible to hold the boring boat in the channel of the river. The party was at work on this section at the end of the fiscal year, when there remained about two days' work in order to complete all the borings necessary from Grafton to Lasalle.

*Discharge measurements.*—Four sets of discharge measurements were made at Peoria with floats while the Price current meter was being repaired and rated by the manufacturer. The meter was returned from the factory about July 10, and was used until August 1.

This work was suspended while the force was concentrated on topographical work. After this was completed the taking of discharge measurements was again resumed on March 21, under Mr. D. W. Webster. Up to the end of the fiscal year the following number of measurements had been taken: Peoria, 20; Havana, 15; Beardstown, 13; Pearl, 14; Hadleys Landing, 17; Henry, 2; Ottawa, 2; Divine, 2.

The present season seems to be exceptionally propitious for conducting these
as the spring freshet was the highest since the phenomenal flood of
present seems to promise fairly low water during August.
d of the discharge measurements taken by the United

States Geological Survey at Jackson Creek, Kankakee Cut-off, Elgin, Joliet and Eastern Railroad bridge, Chicago, Burlington and Quincy Railroad bridge at Ottawa, the highway bridge at Lasalle, and the Peoria and Pekin Union Railroad bridge at Peoria.

*Barometric determinations.*—The height of the bluffs has been determined at 310 points between Grafton and Lasalle, or at intervals of 1 mile wherever the bluffs come within the limits of the maps. All but thirty of these have been platted. The results are correct within 3 per cent, as determined by repeated comparisons with transit measurements.

*Field maps.*—The total number of field maps is 382, each 22 inches by 30 inches. As shown in the tabulation, all of the field notes have been platted, and all of the contours drawn and checked. As a rule the contours on any section were drawn by the recorder of the party which did the field work and checked by the observer of the party.

An index map was drawn and traced, showing the relative positions of all the field sheets and their position on the final maps.

*Final maps.*—The following statement shows the present status of work on the final maps:

| | |
|---|---|
| Total number of sheets to be drawn, of which 44 are 12 feet in length and 5 are 6 feet in length | 49 |
| Total number of sheets upon which the topography has been transferred and inked | 49 |
| Total number of sheets upon which the lettering has been stamped | 16 |
| Total number of sheets upon which the section lines and border lines have been drawn | 18 |

In a total of 5,505 ranges of soundings, 670 remain to be inked. The work of drawing the parallels and meridians and stamping on the contour elevations has not yet been commenced. The names of landowners and some minor data are still to be added and a few corrections made.

The line of deepest water has been platted on all of the sheets, and the center line of the proposed waterway, as sketched in by the Board of Engineers, from Grafton to Lasalle, was carefully checked and suitable curves drawn to connect the tangents.

*Gauge records.*—The work of compiling all the gauge records obtainable relating to the Illinois and Des Plaines rivers, between Grafton and Lockport, has been prosecuted diligently, and a large amount of valuable data has been secured, as shown in the following summary of results:

| | Dates. | | |
|---|---|---|---|
| Grafton | Aug. 12, 1879 | to | Sept. 30, 1892 |
| Do | Apr. 1, 1894 | | June 30, 1904 |
| Deerplain | Nov. 7, 1878 | | June 30, 1880 |
| Hardin | Nov. 10, 1878 | | June 30, 1880 |
| Columbiana | Nov. 4, 1878 | | Oct. 16, 1880 |
| Kampsville, below dam | Mar. 3, 1881 | | Nov. 17, 1883 |
| Do | May 18, 1887 | | June 30, 1904 |
| Kampsville, above dam | Sept. 10, 1893 | | June 30, 1904 |
| Pearl | Nov. 10, 1878 | | May 14, 1881 |
| Do | Jan. 1, 1885 | | June 30, 1904 |
| Valley City | Nov. 1, 1878 | | June 30, 1880 |
| Do | Dec. 18, 1883 | | June 30, 1904 |
| Meredosia | Nov. 1, 1878 | | May 30, 1881 |
| Do | Jan. 19, 1884 | | June 30, 1904 |
| Lagrange lock, below dam | July 19, 1882 | | June 30, 1904 |
| Lagrange lock, above dam | May 1, 1890 | | June 30, 1904 |
| Beardstown | Oct. 28, 1878 | | Nov. 20, 1895 |
| Do | Mar. 1, 1898 | | June 30, 1904 |
| Browning | Oct. 10, 1903 | | Dec. 31, 1903 |
| Sharps Landing | Oct. 26, 1878 | | June 30, 1880 |
| Holmes Landing | Oct. 16, 1903 | | Dec. 31, 1903 |
| Bath | Oct. 24, 1878 | | Mar. 31, 1879 |
| Havana | Oct. 23, 1878 | | May 31, 1881 |
| Do | Jan. 1, 1896 | | June 30, 1904 |
| Liverpool | Nov. 20, 1903 | | Dec. 26, 1903 |
| Copperas Creek lock, below dam | Sept. 1, 1873 | | June 30, 1904 |
| Copperas Creek lock, above dam | Oct. 6, 1877 | | June 30, 1904 |
| Kingston mines | Dec. 4, 1903 | | June 30, 1904 |
| Pekin | Mar. 31, 1898 | | June 30, 1904 |
| Peoria, lower wagon bridge | Dec. 1, 1870 | | Sept. 30, 1871 |
| Do | Jan. 13, 1873 | | Nov. 30, 1877 |
| Do | May 1, 1882 | | June 30, 1904 |
| Peoria, upper wagon bridge | Feb. 6, 1891 | | Feb. 20, 1904 |
| Chillicothe | Apr. 19, 1903 | | June 30, 1904 |

| | Dates. | |
|---|---|---|
| Lacon | Dec. 1, 1903 to | June 30, 1904 |
| Henry, below dam | Dec. 1, 1870 | June 30, 1904 |
| Henry, above dam | Sept. 18, 1871 | June 30, 1904 |
| Bureau | Nov. 22, 1903 | June 30, 1904 |
| Lasalle | Jan. 1, 1867 | Nov. 30, 1877 |
| Do | June 19, 1893 | Nov. 19, 1894 |
| Do | Apr. 1, 1897 | June 30, 1904 |
| Do | Mar. 13, 1903 | Sept. 17, 1903 |
| Utica | Apr. 4, 1900 | Nov. 30, 1900 |
| Lasalle County farm | Apr. 1, 1900 | Nov. 30, 1900 |
| Ottawa | Mar. 12, 1903 | Feb. 13, 1904 |
| Fleming farm, between Ottawa and Marseilles | Mar. 29, 1900 | Nov. 30, 1900 |
| Marseilles | Apr. 15, 1900 | Nov. 30, 1900 |
| 3 miles east of Marseilles | Apr. 15, 1900 | Nov. 30, 1900 |
| Seneca | Apr. 21, 1900 | Nov. 30, 1900 |
| Do | Mar. 11, 1903 | Aug. 26, 1903 |
| Morris | Mar. 12, 1887 | July 30, 1887 |
| Do | June 20, 1893 | Nov. 30, 1900 |
| Do | Apr. 20, 1903 | June 30, 1904 |
| Elgin, Joliet and Eastern Railroad bridge, near Divine, Ill | Apr. 25, 1900 | Nov. 30, 1900 |
| Do | Jan. 1, 1903 | Feb. 6, 1904 |
| Kankakee Cut-off | Jan. 1, 1903 | Dec. 27, 1903 |
| Mouth of Jackson Creek, near Channahon, Ill | Apr. 2, 1900 | Nov. 30, 1900 |
| Do | Apr. 17, 1903 | June 30, 1904 |
| Do | June 2, 1902 | Mar. 8, 1904 |
| Joilet, below dam | Jan. 1, 1903 | Apr. 18, 1904 |
| Joilet, above dam | July 31, 1901 | Apr. 18, 1904 |
| Do | July 6, 1893 | Nov. 20, 1894 |
| Do | Feb. 1, 1897 | Nov. 30, 1903 |

A tabulation was prepared showing a comparison of the results of the levels of 1866 and 1867 with the precise levels of 1903 from Lasalle to Copperas Creek, for the purpose of computing the elevations of the old gauges at Grafton, Deerplain, Hardin, Beardstown, Sharps Landing, Bath, Havana, Copperas Creek, and Peoria.

The elevations of the zeros of all gauges used in the survey of 1879 were determined from the original level notes of that survey, and refer to Memphis datum; also the elevations of the zeros for all gauge readings on record for Pearl, Valley City, Meredosia, and Lagrange.

Second and third copies were made of one hundred and six years of gauge readings pertaining to the gauges from Grafton to Valley City.

*Miscellaneous.*—For the use of and at the request of Assist. Engineer C. V. Brainard, tracings were prepared showing the location of all bridges, piers, and pile protections from Pearl to Peoria, inclusive; also a table showing the length of draw span, diameter of draw pier, and the clear width of channel for all bridges from Pekin to Peru, inclusive.

For the use of the boring party in locating borings, tracings were made of the river from Grafton to Lasalle showing the topography and triangulation stations adjacent to the river.

Duplicate copies were made and checked of 364 sheets of triangulation data.

On January 30 the Peoria office was moved from No. 1219 Perry avenue to No. 1515 North Monroe street, to which latter location the office equipment on the quarter boat *Margaret* was moved on February 4 and 5.

Four transits with four tripods and twelve stadia boards were packed and returned to the districts from which they were borrowed. Three transits and one level, with four tripods, two level rods and nine stadia boards were packed and shipped to the engineer depot, Washington Barracks, D. C.

The United States Geological Survey and the Chicago sanitary district have been permitted to trace various portions of the final maps, and numerous interested parties have been furnished with elevations and miscellaneous data obtained on this survey.

On June 20 to 26, inclusive, the Board of Engineers in charge of this work, together with junior engineers J. W. Woermann and Henry Fox, made a tour of inspection over the line of the proposed waterway from Chicago to St. Louis. On this trip, in addition to considering the line of location, the Board decided to prepare a map to a scale of 1¼ inches to the mile, to be subsequently photolithographed to a scale of 1 inch to the mile; also an index map to a scale of 1 inch to 4 miles, to be subsequently
ed to 1 inch to 5 miles. The Board also sketched in the center line of the pro-
waterway on the final maps from Grafton to Lasalle.

For the use of the Board of Engineers on this trip, a preliminary profile was prepared showing the high-water lines of 1844, 1902, and 1904 from Grafton to Lasalle and the low-water lines of 1894 and 1901, together with the lowest water on record previous to the construction of the dams in the river; also statements showing the present condition of work on the fianal maps, the total and monthly disbursements to June 30, 1904, the approximate cost of completing the field work, maps, and estimates of this survey, and estimates in detail showing the cost of reproducing the final maps by tracing and blueprinting as compared with photolithographing in either one or two colors.

*Clerical.*—Proposals were issued from time to time for groceries, fresh and salt meats, dishes, kitchen utensils, stakes, stationery, drawing materials, transits, and miscellaneous tools.

The cost in detail of constructing the quarter boats *Sangamon* and *La Salle* was compiled and tabulated. Work has been in progress upon the computation of the cost of the various branches of the field and office work.

The monthly pay rolls, ration, and civil-service reports, ten-day, monthly, and annual reports were prepared, quarterly returns of property submitted, accounts audited, cash statements rendered, and other clerical work attended to.

The following assistants have rendered faithful and efficient service: Junior engineers, Henry Fox, Fred Morley, John H. Best, F. B. Duis, Edmund Polk, Clarence A. Clement, F. C. Woermann, A. W. Sargent, H. D. Harting, Earl G. Marsh, C. M. Waters, H. N. Chase; draftsmen, C. G. Tudor and B. F. Davenport; clerks, G. C. Falconer and K. H. Louis; surveyors, T. C. Thogerson, W. Arthur Lafler, A. C. Wheeler, E. F. Sessinghaus, D. W. Webster, Oscar C. Bruszer, W. N. Lundstrom; Chas. P. Hale, H. L. Mills, A. J. Meidroth, T. Irving Ellis; survey men and recorders, Geo. W. Ramsey, O. W. Boers, R. L. Hauser, W. D. Hudson, Henry T. McGaughan, Robert Foreman, Harold R. Howes, E. N. Turner, A. D. Llewellyn, L. P. Peterson, J. E. Walbridge, Wm. H. Goodwin, R. A. Hopkins, M. P. Blair, David McCluggage, R. M. Williamson, C. M. Booth, J. A. Moskovitz, Clyde L. Emmons, W. F. Meidroth, jr., John D. Price, B. E. Dillon.

Very respectfully, your obedient servant,

J. W. WOERMANN,
*Junior Engineer.*

Col. O. H. ERNST,
*Corps of Engineers, President Board of Engineers,*
*Waterway from Lockport, Ill., to Mouth of Illinois River.*

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## K K 6.

## EXAMINATION OF CALUMET RIVER, ILLINOIS AND INDIANA.

[Printed in House Doc. No. 172, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 11, 1903.*

SIR: I have the honor to submit herewith reports, dated August 3 and September 16, 1903, with map,[a] by Col. O. H. Ernst, Corps of Engineers, on examination of Calumet River, Illinois and Indiana, ordered by section 1 of the river and harbor act approved June 13, 1902.

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[a] Not reprinted; printed in House Doc. No. 172, Fifty-eighth Congress, second session.

Calumet River is now being improved by the General Government under a project to provide a channel 200 feet wide, 20 feet deep (excavating to a depth of 21 feet), to One hundred and twenty-second street (about 4.2 miles from the mouth); 16 feet deep from One hundred and twenty-second street to the forks (about 5.5 miles from the mouth), and 10 feet deep from the forks to a point one-half mile above Hammond (10.5 miles from the mouth). The improvement contemplated by the present examination involves the modification of the existing project so as—

1. To provide a navigable channel 22 feet deep from the mouth to One hundred and sixth street.

2. To include in the improvement the old channel of the river between One hundred and thirteenth and One hundred and sixteenth streets.

With reference to that part of the stream below the forks, Colonel Ernst states that the proposed increase in depth between the mouth and One hundred and sixth street is not required at this time, and that the old bed of the river between One hundred and thirteenth and One hundred and sixteenth streets is of no value to the United States, except that a portion of it at one end might be utilized for a turning basin. In his opinion this section is worthy of improvement by the General Government to the extent proposed by the existing project.

As regards the portion above the forks he states for reasons given that the work is not worthy to be undertaken by the United States.

Colonel Ernst estimates the cost of projected work at $662,480.50, which includes the excavation of five turning basins having a least diameter of 650 feet, four of them 21 feet deep, the other 16 feet deep. The sum of $10,000 will be required annually for maintenance. This estimate does not provide for the cost of land required for the turning basins estimated to cost $161,342, which the local officer thinks should be given for the purpose free of charge, and he is of opinion that the adoption of this feature of the project should be conditional upon a free right of way.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors under the provisions of section 3 of the said act of June 13, 1902, and attention is invited to its reports on the subject in letter of August 14 and indorsement of November 11, 1903, herewith.

I concur in the views and recommendations of the Board as summarized in its report of November 11, 1903, viz:

> That so much of the site of the former channel between One hundred and thirteenth and One hundred and sixteeth streets as is not needed by the United States for a turning basin be abandoned as navigable waters of the United States, and that the project for the improvement of the Calumet River be this:
>
> To provide a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with five turning basins, at a total estimated cost of $662,480.50, and $10,000 per annum for maintenance; and to acquire, as prescribed in the act of June 13, 1902, the land required for a channel 200 feet in width from the forks to a point one-half mile above Hammond, Ind.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

## REPORT OF COL. O. H. ERNST, CORPS OF ENGINEERS.

CORPS OF ENGINEERS, UNITED STATES ARMY,
*Chicago, Ill., August 3, 1903.*

GENERAL: The item in the river and harbor act approved June 13, 1902, which appropriated money for the improvement of Calumet River, Illinois and Indiana, contained the following proviso, viz:

> and an examination shall be made with a view to securing a navigable channel of twenty-two feet from the mouth of said river to One hundred and sixth street, in the city of Chicago, and twenty feet from One hundred and sixth street to One hundred and twenty-second street, including also the old channel of the river between One hundred and thirteenth street and One hundred and sixteenth street, and sixteen feet from One hundred and twenty-second street to the forks of said river, and ten feet from the forks of said river to a point one-half mile above Hammond, in the State of Indiana.

In compliance with your instructions I have made the examination required, and I have the honor to report the results:

Calumet River constitutes the inner portion of Calumet Harbor, and beginning at the mouth, has been widened, deepened, and straightened for a distance of several miles upstream, so as to make it capable of receiving the largest lake vessels. The work is still in progress, and an extension of it farther upstream is contemplated under the present project. The depth to be provided should be the same as that provided at the other important harbors on the Great Lakes, such as Duluth, Cleveland, and Buffalo, and in the channels between the lakes. That depth is such as to provide for vessels drawing 20 feet, and at the Calumet River is described as 21 feet below Chicago city datum. It is the depth sought in the present project as far up as One hundred and twenty-second street, a distance of 4.2 miles from the mouth. There is no need for a greater depth while that in the other harbors and channels remains as it is. The proposed increase in depth from 21 feet to 22 feet between the mouth and One hundred and sixth street is not required at this time.

The depth of 20 feet between One hundred and sixth street and One hundred and twenty-second street mentioned in the order for the examination has already been adopted in the existing project, except that in the project it is defined as 21 feet below Chicago city datum. It is the same as that below One hundred and sixth street, as it should be, since it is designed to accommodate the same class of vessels.

"The old channel of the river between One hundred and thirteenth and One hundred and sixteenth streets" was abandoned as a navigable channel when the cut-off was made at this place, because of its tortuousness. The title to the old bed probably still rests in the United States, and that is a cause of embarrassment to the adjoining property owners, who find a derelict piece of land (formerly water) thrust in between their holdings. The old bed is of no value to the United States except that a portion of it at one end might be utilized for a turning basin if Congress should authorize one to be constructed. There is a bed of rock in this vicinity, however, which is adding largely to the cost of excavating the main channel, and it is not now certain that the site can be used for a turning basin. * * *

The depth of "16 feet from One hundred and twenty-second street to the forks of said river" is the same as that adopted in the present project. It seems a very proper depth for the present.

expenditure would result only in a waste of the public money, and the work is not worthy to be undertaken by the United States.

Very respectfully, your obedient servant,

O. H. Ernst,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

[First indorsement.]

Office Chief of Engineers, U. S. Army,
*August 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Second indorsement.]

Board of Engineers for Rivers and Harbors,
*Washington, D. C., August 14, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, with report of this date.

For the Board:

Chas. J. Allen,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

[Fifth indorsement.]

Office Chief of Engineers, U. S. Army,
*September 22, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report containing estimates for turning basins as recommended.

By command of Brig. Gen. Gillespie:

H. F. Hodges,
*Major, Corps of Engineers.*

[Tenth indorsement.]

Board of Engineers for Rivers and Harbors,
*Washington, D. C., November 11, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board has considered other data recently received, and on October 16, 1903, through a committee, visited Chicago and inspected the Calumet River from its mouth to a point one-half mile above Hammond.

The opinions arrived at by the Board with reference to turning basins below the forks, and to work above that point, are as follows:

No commerce would, in the immediate future, be benefited by any improvement of the section of river above the forks to an extent commensurate with the cost. However, considering the history of commercial and manufacturing developments below the forks, and the gradual approach of manufacturing enterprises toward this section, it is probable that, with the lapse of time, it will be desirable to extend the improvement progressively from the forks upward, and it is recommended that there be acquired, free of cost to the United States, deeds for the land necessary for a channel 200 feet wide in this stretch, and releases from liability for damages to adjacent property owners, as provided for in the river and harbor act of June 13, 1902.

A number of turning basins should be provided between the mouth of the river and the forks. In the district officer's supplemental report herewith he recommends the construction of five turning basins, to be located approximately as shown on the blueprint accompanying that report, and estimates the cost of these, exclusive of the cost of the necessary land, at $163,658. The Board believes that the construction of these turning basins at the cost named is desirable, provided the lands upon which they are to be located shall be deeded to the United States free of cost.

To sum up, the Board recommends that so much of the site of the former channel between One hundred and thirteenth and One hundred and sixteenth streets as is not needed by the United States for a turning basin be abandoned as navigable waters of the United States, and that the project for the improvement of the Calumet River be this:

To provide a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with 5 turning basins, at a total estimated cost of $662,480.50 and $10,000 per annum for maintenance; and to acquire, as prescribed in the act of June 13, 1902, the land required for a channel 200 feet in width from the forks to a point one-half mile above Hammond, Ind.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., August 14, 1903.*

GENERAL: Inviting attention to report by Col. O. H. Ernst, Corps of Engineers, on an examination of Calumet River, Illinois and Indiana, referred to the Board of Engineers for Rivers and Harbors by first indorsement, Office Chief of Engineers, dated August 10, 1903, the Board has the honor to submit the following report, based upon Colonel Ernst's report above referred to and other data available.

The present project for Calumet River, adopted by the river and harbor act of June 13, 1902, is to provide a channel 20 feet deep to One hundred and twenty-second street (about 4.2 miles from the mouth), 16 feet deep from One hundred and twenty-second street to the forks (about 5.5 miles from the mouth), and 10 feet deep from the forks to a point one-half mile above Hammond (10.5 miles from the mouth); the width throughout to be 200 feet. The accompanying report of the district officer is a report on an examination made in compliance with the same act—

> with a view to securing a navigable channel of twenty-two feet from the mouth of said river to One hundred and sixth street, in the city of Chicago, and twenty feet from One hundred and sixth street to One hundred and twenty-second street, including also the old channel of the river between One hundred and thirteenth street and One hundred and sixteenth street, and sixteen feet from One hundred and twenty-second street to the forks of said river, and ten feet from the forks of said river to a point one-half mile above Hammond, in the State of Indiana.

It is explained in the district officer's report and in the Annual Report of the Chief of Engineers for 1902, page 2107, that the words "depth of 20 feet" have heretofore been interpreted to mean a depth which vessels drawing 20 feet can navigate. Such a depth is obtained by excavating to the depth of 21 feet below Chicago datum (579.48 feet above mean tide at New York and 1.48 feet above the plane of standard low water provisionally adopted for the most recent Lake Survey charts of Lake Michigan). This is the depth that has been provided between the piers and in the lower portion of the Calumet River and is sufficient for the largest vessels that navigate the lakes. The fluctuations of level of the lake are considerable and rapid, and at long intervals there might be for brief periods an actual depth not greater than 20 feet. The benefit obtained by providing a channel 22 feet deep below Chicago datum, thus guarding against unusual and infrequent low waters, would not be proportionate to the expense involved.

*The mouth to One hundred and sixth street.*—The Board agrees with the district officer that it is not advisable to provide for the stretch of river between the mouth and One hundred and sixth street (about 2 miles) a greater depth than 21 feet below Chicago datum. This depth has already been provided under a former project, but a survey made in 1901 showed that the channel had shoaled somewhat (Annual Report, Chief of Engineers, 1902, p. 2107). This stretch should be redredged to the depth of 21 feet below Chicago datum and that depth should be maintained.

*One hundred and sixth to One hundred and twenty-second streets.*—The depth called for in the item ordering the examination of this stretch of the river is the same as that provided in the existing project for improvement, viz, 20 feet. The Board agrees with the district officer in the opinion that the project should be carried out by excavating to 21 feet below Chicago datum.

For reasons fully set forth in his report, the Board agrees with the district officer that it is inadvisable to dredge out the abandoned channel between One hundred and thirteenth and One hundred and sixteenth streets. So much of the site of this former channel as is needed for a turning basin should be retained for that purpose, and the balance should be formally abandoned as navigable waters of the United States. The subject of turning basins is referred to again below.

*One hundred and twenty-second street to the forks.*—The present project calls for a depth of 16 feet in this stretch. The examination is directed with a view to securing that depth. The Board agrees with the district officer that the depth of 16 feet will be ample.

It appears, therefore, that carrying out that part of the existing project, which relates to the river below the forks will give a harbor 200 feet wide and 4.2 miles long, having an available depth of 20 feet, and an additional 1.3 miles of channel 200 feet wide, having an available depth of 16 feet. This, in the opinion of the district officer, in which opinion the Board concurs, will keep the facilities of this port in advance of the requirements of navigation, and will afford abundant room for the further development of the locality.

*The forks to a point one-half mile above Hammond.*—No present necessity for an enlarged channel in this stretch of the river is apparent. * * *

* * * * * * *

The Board is of the opinion that no work should be done at the present time on this portion of the river looking toward an increase of depth. A 10-foot channel would be useless. There is now no commerce on this stretch, and experience shows that unless continuous and expensive dredging be done no channel can be maintained. * * * A number of turning basins should be provided between the mouth of the river and the forks. The present project contains no provision for such basins.

To sum up, the Board recommends:

(*a*) That the present project for the improvement of Calumet River, as far as the forks, be continued, and that work between the forks and one-half mile above Hammond be postponed subject to the contingencies mentioned in paragraph 8.

(*b*) That the district officer be requested to prepare a detailed estimate of the cost of carrying out so much of the present project as relates to the river below the forks, including the necessary turning basins.

(*c*) That so much of the site of the former channel between One hundred and thirteenth and One hundred and sixteenth streets as is not needed by the United States for a turning basin be abandoned as navigable waters of the United States.

Respectfully submitted.

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers.*
H. F. HODGES,
*Major, Corps of Engineers.*
EDW. BURR,
*Major, Corps of Engineers.*
C. H. MCKINSTRY,
*Captain, Corps of Engineers.*
W. V. JUDSON,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

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## SUPPLEMENTARY REPORT ON EXAMINATION.

CORPS OF ENGINEERS, UNITED STATES ARMY,
*Chicago, Ill., September 16, 1903.*

GENERAL: In compliance with the instructions contained in your letter of the 10th instant, I have the honor to submit estimates for "a number of turning basins" in the Calumet River, as recommended by the Board of Engineers for Rivers and Harbors.

It is proposed to construct five of these basins, located as shown upon the inclosed blueprint. These locations are provisional only, and are subject to change if, after further examination, rock be discovered or if unusual difficulty be found in making terms with the owners of the land. The basins are to have a least diameter of 650 feet, and the same depth as the main channel adjoining, which is 21 feet for all except No. 5, and for that one is 16 feet.

The volume of excavation required in addition to that for the main channel (for which estimates have already been submitted) measured in place is:

| | Cubic yards. |
|---|---|
| For basin No. 1 | 54,500 |
| For basin No. 2 | 161,400 |
| For basin No. 3 | 137,000 |
| For basin No. 4 | 200,800 |
| For basin No. 5 | 190,200 |
| Total | 743,900 |

which at 20 cents per cubic yard would cost $148,780, to which is to be added 10 per cent for contingencies, making the total cost of excavation $163,658.

It is impossible to state what the value of the land will be which must be taken for these basins. The development of the locality and the consequent increase of values has been very great and is still progressing. Thus far all land required for widening and straightening the river has been given to the United States free of charge. That rule may, and probably will, be followed voluntarily by the owners in the case of some of the basins. It would be but proper, I think, for the United States to require that it be followed in the case of all; that is, that the adoption of the project shall be conditioned upon a free right of way. But as there has been no fixed policy established by Congress upon that point, I give the areas and such information as I have been able to obtain concerning values.

The area in acres required in addition to that for the main channel, and the value of land per acre, as stated by property holders, is for—

| | Value per acre. | Total value. |
|---|---|---|
| Basin No. 1: | | |
| 2.851 acres | 0 to $8,712 | 0 to $24,838 |
| Basin No. 2: | | |
| 4.235 acres | $10,000 to 26,136 | $42,350 to 110,686 |
| Basin No. 3: | | |
| 5.888 acres | 6,000 to 8,000 | 35,328 to 47,104 |
| Basin No. 4: | | |
| 4.855 acres | 6,000 | 29,130 |
| Basin No. 5: | | |
| 5.242 acres | 1,500 to 2,500 | 7,863 to 13,105 |

As a very rough approximation, the sum of $161,342 may be added to the cost of excavation to cover the purchase of lands, making the total estimated cost of the project $325,000.

Very respectfully, your obedient servant,

O. H. Ernst,
*Colonel, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

# APPENDIX L L.

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## IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS, AND CONSTRUCTION OF ILLINOIS AND MISSISSIPPI CANAL.

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*REPORT OF MAJ. C. S. RICHÉ, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Illinois River, Illinois.
2. Operating and care of Lagrange and Kampsville locks, Illinois River, and approaches thereto.
3. Illinois and Mississippi Canal.

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United States Engineer Office,
*Chicago, Ill., July 15, 1904.*

General: I have the honor to transmit herewith annual reports upon works in my charge for the fiscal year ending June 30, 1904. * * *

Very respectfully, your obedient servant,

C. S. Riché,
*Major, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

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## L L 1.

## IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS.

Owing to the high stage of water throughout the year no dredging was necessary. The boat yard and headquarters were removed from Kampsville, Ill., to Beardstown, Ill., where new ways, shops, and storehouse were built upon ground leased for the purpose. Extensive repairs to the fleet were undertaken, one new barge being built, three dredges repaired, the steamer *Pearl* overhauled and parts renewed where necessary, and barges and scows rebuilt. This work was in progress at close of the fiscal year.

Complaints having been made by the river interests that many of the highway and railroad bridges over Illinois River were obstructive to navigation, a public hearing was ordered by the Secretary of War, and was held at the engineer office in Chicago early in January, 1904. As a result of this hearing, at which the river interests and the bridge owners were represented, orders were issued by the Secretary of War, under date of February 27, 1904, directing alterations in the bridges involved. Owing to high water and the difficulty of securing pile-driving outfits on the river these alterations have been somewhat delayed, but are in progress at the close of the fiscal year, and it is expected that they will be completed by September 1, 1904.

Permission has been granted by the Secretary of War to the sanitary district of Chicago to lower the dams at Kampsville and Lagrange 2 feet, providing movable crests for the dams. This work is to be done at the expense of the sanitary district, under supervision of the district officer. The work has not yet been done.

Report of Asst. Engineer C. V. Brainard is herewith.

### PROPOSED APPLICATION OF FUNDS.

It is proposed to apply these funds to maintaining the navigable channel of 7 feet depth between Copperas Creek dam and the mouth of the river, removing snags, care and repair of plant and property, and in making such local surveys as may be necessary from time to time.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $80,603.48 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 15,481.30 |
| July 1, 1904, balance unexpended | 65,122.18 |
| July 1, 1904, outstanding liabilities | 1,500.00 |
| July 1, 1904, balance available | 63,622.18 |
| Amount (estimated) required for completion of existing project | 182,000.00 |

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### APPROPRIATIONS.

| | |
|---|---|
| June 30, 1880, available from previous appropriations | $38,337.81 |
| Act of— | |
| June 14, 1880 | 110,000.00 |
| March 3, 1881 | 250,000.00 |
| August 2, 1882 | 175,000.00 |
| July 5, 1884 | 100,000.00 |
| August 5, 1886 | 112,500.00 |
| August 11, 1888 | 200,000.00 |
| Joint resolution September 29, 1890 | 200,000.00 |
| Act of— | |
| July 13, 1892 | 100,000.00 |
| August 18, 1894 | 35,000.00 |
| June 3, 1896 | 40,000.00 |
| March 3, 1899 | 100,000.00 |
| June 3, 1902 | 75,000.00 |
| | 1,535,837.81 |
| Received from all other sources | 535.40 |
| Total | 1,536,373.21 |
| Expended to June 30, 1904 | 1,471,251.03 |
| Balance unexpended June 30, 1904 | 65,122.18 |

### CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1904.

| Name and address of contractor. | Nature of contract. | Date. | To expire— |
|---|---|---|---|
| Marsh & Bingham Co., Chicago, Ill. | 150,467 feet B. M. of fir timber and lumber. | Nov. 18, 1903 | Feb. 18, 1904 |

### COMMERCIAL STATISTICS.

*Arrivals and departures of steamboats and barges at St. Louis, Mo., via Illinois River, calendar year 1903.*

| Month. | Arrivals. | Departures. | Receipts. | Shipments. |
|---|---|---|---|---|
| | | | *Tons.* | *Tons.* |
| January | | | | |
| February | | | | |
| March | 8 | 6 | | |
| April | 9 | 8 | | |
| May | 8 | 11 | | |
| June | 8 | 4 | | |
| July | 14 | 8 | | |
| August | 12 | 9 | | |
| September | 11 | 9 | | |
| October | 11 | 12 | | |
| November | 13 | 8 | | |
| December | 1 | | | |
| Total | 95 | 75 | 12,085 | 8,825 |

### REPORT OF MR. C. V. BRAINARD, ASSISTANT ENGINEER.

BEARDSTOWN, ILL., *July 2, 1904.*

CAPTAIN: I have the honor to submit the following report of operations for improving Illinois River for the fiscal year ending June 30, 1904:

The work of the year has consisted in keeping the river clear of snags and repairs to plant. Owing to the good stage of water throughout the entire year no dredging was necessary. There is a navigable channel of approximately 7 feet at low water, the worst place being about about 1 mile of the river just below Naples, where the depth ranges from 6½ to 7 feet.

In August the railroad running to the river opposite Kampsville lock was abandoned and the track torn up. Authority was asked for and obtained to move the boat yard to Beardstown, where the shipping facilities were better and land could be obtained that was above overflow.

In September the old ways, storehouse, and shop on the bank at Kampsville lock were loaded on barges, and in October these and all the other floating property, excepting steamer *Marion* and quarter boat *No. 1*, were towed to Beardstown by the steamer *Pearl*.

At Beardstown the following work was accomplished:

The shop, 18 by 50 feet, was erected on the bank, and a planer and saw and engine to run them set up in same. A well 32 feet deep was driven for a water supply.

The storehouse was remodeled and built, 18 by 60 feet and one story in height, instead of two as before.

### PLANT.

One new barge, 4½ by 20 by 100 feet, was built of Oregon fir.

### CARE AND REPAIR OF PROPERTY AND PLANT.

A set of ways was put in, extending in the water 55 feet at low water and 120 feet on the bank.

*Dredge Apache.*—The boom and "A" frame were taken off, the dredge hauled out, and the following new work done:

Head block, except the bottom timber; lower third of posts of truss in both gunwales, three bottom planks, one-half the planking of each gunwale, one-half the timbers, and all the planking of the rake, stern spud well, and one-third of one floor timber. The bottom, head, deck, rake, and lower half of each gunwale were calked and all except the bottom painted.

*Dredge No. [illegible].*—Enough minor repairs were made to put the dredge in commission.

*Dredge No. [illegible].*—The crane was taken down preparatory to hauling out on the bank.

*Steamer Pearl.*—Fourteen wheel arms and one rocker plank were renewed and the gunwales calked above light water.

*Barge No. [illegible].*—The barge was hauled out, the deck, rakes, floor timbers and decayed timber in gunwales and bulkhead removed. New floor timbers were put in and the bottom calked.

*Dump scow No. [illegible].*—This was hauled out and the following new work done: Gunwales at ends of scow, bulkheads at ends of pockets, one-fourth of the pocket decking, 20 feet of one gunwale, posts holding ratchet for closing doors, and all nosing above light water. Everything except the bottom was calked and painted and the scow punched.

*No. 10.*—This was hauled out and the following new work done: Gunwales at ends of scow, bulkheads at ends of pockets, 24 feet of one gunwale strake, one-third the pocket decking, top decking at one end of scow, posts holding ratchet for closing doors, all nosing above light water. Calked everything above the bottom, and the scow was punched.

The three dredges, steamers *Pearl* and *Fox*, three quarter boats and blacksmith shop had the roofs painted and sanded.

Ten cars of Oregon fir for repairing the fleet were received and transferred from the railroad to the work.

Twenty-four wooden rollers were made.

### SNAGGING.

Steamer *Pearl* made a trip over the river in August and cleared the river of snags, 94 being removed.

Very respectfully, your obedient servant,

C. V. Brainard,
*Assistant Engineer.*

*Capt. C. S. Riche,*
*Corps of Engineers.*

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## L L 2.

## OPERATING AND CARE OF LAGRANGE AND KAMPSVILLE LOCKS, ILLINOIS RIVER, AND APPROACHES THERETO.

These locks and dams have been operated and maintained under the indefinite appropriation provided by section 4 of the river and harbor act of July 5, 1884.

About 929 cubic yards of mud was dredged from upper entrance to Lagrange lock, and about the same amount placed behind the upper revetment. The entrances to Kampsville lock were also dredged, about 1,712 cubic yards being removed, and at this lock a well 232 feet in depth was drilled.

Permission was granted to the sanitary district of Chicago by the Secretary of War, under date of May 23, 1904, to lower the dams at Kampsville and Lagrange 2 feet, providing them with movable crests.

The accompanying report of Asst. Engineer C. V. Brainard contains tables showing the number of boats navigating the river, the number of times they have passed the locks during the past fiscal year, and the tonnage of various classes of goods.

*Summarized statement of expenses from appropriation for operating and care of canals and other works of navigation (indefinite) applied to Lagrange and Kampsville locks, Illinois River.*

| | | |
|---|---|---|
| Lagrange lock: | | |
| Services | $4,736.64 | |
| Materials | 345.80 | |
| Supplies | 181.01 | |
| Property | 85.00 | |
| Freight | 1.45 | |
| Total | | $5,349.90 |
| Kampsville lock: | | |
| Services | 4,886.17 | |
| Materials | 170.75 | |
| Supplies | 52.22 | |
| Telephone | 18.00 | |
| Total | | 5,127.14 |
| | | 10,477.04 |

## *Money statements.*

### LAGRANGE LOCK.

| | |
|---|---|
| July 1, 1903, allotment for year 1904 | $10,000.00 |
| June 30, 1904, amount expended during year | 5,349.90 |
| July 1, 1904, balance unexpended | 4,650.10 |
| July 1, 1904, outstanding liabilities | 23.82 |
| July 1, 1904, balance available | 4,626.28 |

### KAMPSVILLE LOCK.

| | |
|---|---|
| July 1, 1903, allotment for year 1904 | $10,000.00 |
| June 30, 1904, amount expended during year | 5,127.14 |
| July 1, 1904, balance unexpended | 4,872.86 |
| July 1, 1904, outstanding liabilites | 64.33 |
| July 1, 1904, balance available | 4,808.53 |

### COMMERCIAL STATISTICS FOR FISCAL YEAR ENDING JUNE 30, 1904.

| | | Tonnage passing— | |
|---|---|---|---|
| | | Lagrange lock. | Kampsville lock. |
| Steamboats | number | 467 | 273 |
| Barges | do | 262 | 71 |
| Tonnage of steamboats | tons | 96,864 | 88,440 |
| Tonnage of barges | do | 40,851 | 14,670 |
| General merchandise | do | 8,325 | 5,296 |
| Passengers | number | 13,610 | 10,764 |
| Live stock | head | 2,088 | 21,526 |
| Corn | tons | 3,918 | 256 |
| Wheat | do | 2,900 | 1,272 |
| Apples | do | 322 | 640 |
| Logs and lumber | do | 2,795 | 688 |
| Ties | do | | 400 |
| Coal | do | 205 | |
| Stave bolts | do | 300 | |
| Ice | do | 600 | 600 |

*List of boats navigating the Illinois River during the fiscal year ending June 30, 1904.*

| Name. | Tonnage. | Trips passed— Lagrange lock. | Trips passed— Kampsville lock. |
|---|---|---|---|
| Bald Eagle | 590 | 132 | 141 |
| Eleonore | 97 | 82 | 18 |
| Mary | 50 | 41 | 14 |
| Ebaugh | 50 | 29 | ............ |
| City of Peoria | 128 | 18 | ............ |
| R. G. Schmoldt | 19 | 17 | ............ |
| Illinois | 254 | 15 | 12 |
| H. W. Longfellow | 47 | 13 | ............ |
| Little Dick | 4 | 10 | ............ |
| Susan | 254 | 9 | 1 |
| J. S | 236 | 8 | 8 |
| Polar Wave | 150 | 6 | 6 |
| Imperial | 94 | 6 | ............ |
| Grey Eagle | 555 | 6 | 6 |

## REPORT OF MR. C. V. BRAINARD, ASSISTANT ENGINEER.

BEARDSTOWN, ILL., *July 2, 1904.*

CAPTAIN: I have the honor to submit the following report of operating and care of locks and dams on the Illinois River for the fiscal year ending June 30, 1904.

### LA GRANGE LOCK AND DAM.

The river was open to navigation at this point nine months out of the twelve, being closed by ice from December 9, 1903, until March 8, 1904. From the opening of navigation in March until the 23d of May all boats passed over the dam. From the 23d of May until the 9th of June nine boats passed over the dam, all others passing through the lock. Since the 9th of June all boats passed through the lock.

The upper entrance to the lock was dredged out, 929 cubic yards of mud being scowed away, and about the same amount cast back of the upper revetment. New fences, inclosing the United States grounds, were built on both sides of the river. The lock gates were painted above the water.

### KAMPSVILLE LOCK AND DAM.

The river was open to navigation nine months of the year, being closed by ice the other three. No boats passed here from November 30, 1903, until March 19, 1904. During the months of July, August, September, and November, 1903, all boats passed through the lock. During March and April, 1904, all boats passed over the dam. In October, 1903, 11 boats passed over the dam, the others going through the lock. In May and June, 1904, 15 boats passed over the dam, the others going through the lock.

The entrances to the lock and lock chamber were dredged out, 1,742 cubic yards of mud being scowed away. The ironwork of the lock gates was painted. A well 232 feet in depth was drilled and furnished with a pump.

There are herewith two tables, one showing the traffic by each lock for the fiscal year, the other showing the principal boats navigating the Illinois River, giving their tonnage and the number of times each passed the two locks. In addition to the list of boats given, 50 other boats, varying in size from 4 tons to 200 tons each, made 96 trips, 35 of these boats being gasoline or steam yachts of less than 10 tons capacity.

In accordance with the joint resolution of Congress approved April 21, 1904, authorizing the Secretary of War in his discretion to permit the sanitary district of Chicago to lower the two Government dams in the Illinois River, permission was granted to the sanitary district, under certain restrictions, to lower the dams 2 feet. Arrangements are now being made and the district will probably do the work during the coming low-water season.

Very respectfully, your obedient servant,

C. V. BRAINARD,
*Assistant Engineer.*

Capt. C. S. RICHÉ,
*Corps of Engineers.*

## L L 3.

## ILLINOIS AND MISSISSIPPI CANAL.

This season has been much more favorable for work on the canal than either of the two preceding seasons, and gratifying progress is being made. When present contracts are completed, the earthwork of the canal will have been practically finished. The contract for earthwork on mile 34 was canceled and the work readvertised and awarded under the same specifications to another contractor. The work under contract with Cogan & Pound for pits and foundations for two locks and four culverts on the western section was taken in hand by the United States and completed at the expense of the contractor.

The contract of Charles Stone for pits and foundations for four aqueduct bridges was canceled. The work was readvertised and let to other contractors, and settlement will be made with Mr. Stone's bondsmen when the work is finished.

The designs for structures on the canal have been practically completed.

As work proceeds on the canal the finished parts and structures must be kept in repair, and naturally the expenses for maintenance become greater and constitute a considerable charge against the appropriation for construction of the canal. This is especially true of the eastern section, where much of the work was completed several years ago, and unless constantly repaired would deteriorate. There has been expended for this purpose the following sums:

| | | |
|---|---|---|
| Eastern section: | | |
| Fiscal year— | | |
| 1901 | $1,960.85 | |
| 1902 | 5,747.83 | |
| 1903 | 14,638.28 | |
| 1904 | 3,924.20 | |
| | | $25,271.16 |
| Western section and feeder: | | |
| Fiscal year— | | |
| 1902 | 1,000.00 | |
| 1903 | 2,000.00 | |
| 1904 | 3,125.11 | |
| | | 6,125.11 |
| Moline wagon bridge | | 25,000.00 |
| Total | | 56,396.27 |

None of this total of $56,396.27 was included in the original estimate for construction of the canal.

*Feeder.*—All earthwork, except removal of crossbanks and grading of six highway bridge approaches, has been completed. Seventy-two thousand four hundred and forty-seven cubic yards of rock have been excavated from mile 1 and used in riprapping slopes of the feeder, the east slope having been riprapped to mile 19 and the west slope to mile 22. Masonry of guard lock and controlling works has been completed, and a large amount of crushed stone and sand stored at aqueduct No. 9 for future use. Plans have been completed for aqueduct crossing Green River, and the work has been begun by the erection of office and warehouse and delivery of material at site and the construction of cofferdams.

During the past year no progress has been made on the dam across Rock River at head of feeder. The Sterling Hydraulic Company claim that their interests will be largely damaged if the dam is built as proposed, and ask that it be built at the site of their present dam. This would give them the benefit of 9 feet additional head, and would obviate the necessity of building a lock to admit boats to the river front of Sterling and Rock Falls. If this dam could be made fixed instead of movable, as originally proposed, it would be of greater benefit for power purposes, and its first cost and cost of maintenance and operation would be reduced to the United States. In such case, however, there would result additional flowage damages above the dam, and investigation is in progress to enable an estimate to be made of what the total additional damage would amount to, in order that the most economical course for the United States to follow may be determined.

No apparent progress has been made during the year in the dispute over highway bridges on the feeder. The highway commissioners petitioned to have the bridges built in accordance with their demands and asked that the United States be prohibited from proceeding with the bridges under proposed plans. The cases were referred to a United States commissioner. The testimony has been taken and a decision is awaited. If appeal from such decision is made by either side, still further delays will result. Meanwhile the funds available for these bridges are becoming less, owing to the delay and the necessity for constructing works at other points along the canal and for the maintenance of completed structures. There is not sufficient money on hand to comply with what appear to be the unreasonable demands of the highway commissioners, nor do the funds on hand now seem sufficient to construct the bridges as originally proposed by this office without dispensing with work which is essential to the opening of the canal.

*Western section.*—All earthwork from feeder junction to and including mile 60 has been done or is under contract. Twenty miles have been entirely completed, 3,293,916 cubic yards of earthwork having been executed. The deep cut at and below Colona is being excavated by hired labor and plant, consisting of steam shovel and railway equipment, owned by the United States.

The tracks of the Chicago, Rock Island and Pacific Railroad Company at Colona have been raised, and abutments and superstructure of bridge over the canal have been completed to carry these tracks. An agreement has been entered into with the Chicago, Burlington and Quincy Railway Company for bridge carrying their tracks over the canal at Colona, and contract for the bridge has been awarded upon plans approved by the railroad company. The south abutment of this bridge has been built and the north abutment is nearly finished.

All the culverts and bridge abutments on western section have been completed, and masonry and superstructures of 23 highway bridges completed, which includes all highway bridges except three, which are to cross the tailbays of locks. All the rest of the masonry on the western section, foundations and superstructures of locks, and foundations and piers for aqueduct bridges have been finished or put under contract.

*Eastern section.*—Work on the eastern section has consisted largely in maintaining the finished portion of the canal and in excavating through Cecil's Slough from miles 20 to 24, much of the material at this point being unstable. Repairs made necessary by floods and ice gorges were made, ditches cleaned, towpath and right-of-way fences repaired, spillway built at Lock 12, roads graded where necessary, railroad track between Locks 5 and 6 taken up and stored, and the rest of the track maintained.

All of the highway bridges from Nos. 1 to 18, inclusive, are complete except approaches to bridge 14. Three aqueducts have been completed, except woodwork, and three railroad bridges have been built. All masonry for locks, culverts, aqueducts, and highway and railway bridges has been completed.

All earthwork on eastern section has been practically completed except on miles 20, 21, 22, and 23, where 85 per cent of mile 20, 29 per cent of mile 22, and 55 per cent of mile 23 has been executed. A plant was purchased and installed during the year for work upon this portion of the canal, consisting of a duplex overhead cableway on mile 20, a western elevating grader drawn by traction engine on mile 22, and a turntable dredge on mile 23. The overhead cableway is being used for the excavation through Cecil's Slough—a peat bog through which a cut 17 feet deep has to be made for about 2 miles. The material is very unstable and difficult to drain. Once the water is drained from it, it is thought there will be little trouble in making the cut. Meanwhile the sides of the cut slough badly and it is probable that the machine will have to be worked two or more times along the cut before sufficient drainage will be had to give reasonable stability.

Attention is invited to House Document No. 297, Fifty-seventh Congress, first session, in regard to additional funds necessary to complete the canal. Meanwhile, by abandoning the navigable feature of the feeder, substituting low level timber trestle bridges for the highway crossings of the feeder, and substituting a fixed crib dam at Sterling for a movable steel and concrete dam, it may be possible to open the canal with the funds on hand. The banks in such case will be largely unrevetted and subject to wash, and many minor matters desirable but not essential would have to be dispensed with.

It is not certain, however, that the funds on hand will suffice for the above, but it is a possibility. As an alternative it may be that a pumping station where the feeder crosses Green River would, by supplying water to the summit level, enable the main line of the canal to be opened at less first cost. This matter is under investigation. Meanwhile work is being confined to the completion of the main line of the canal, and it is expected that this can be accomplished by the close of the calendar year 1905. This, however, is contingent upon all contractors completing their contracts in proper time, which is a matter not entirely nor sufficiently under the control of the United States.

For more detailed information reference is made to attached reports of Asst. Engineer L. L. Wheeler, resident engineer in charge of the western section and feeder, and of Asst. Engineer James C. Long, resident engineer in charge of the eastern section.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,500,480.59 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 458,601.68 |
| July 1, 1904, balance unexpended | 1,041,878.91 |
| July 1, 1904, outstanding liabilities | 25,000.00 |
| July 1, 1904, balance available | 1,016,878.91 |
| July 1, 1904, amount covered by uncompleted contracts | 484,990.57 |

APPROPRIATIONS.

| | |
|---|---|
| July 1, 1890, balance unexpended from previous appropriations | $7,796.46 |
| Act of— | |
| September 19, 1890 | 500,000.00 |
| July 13, 1892 | 500,000.00 |
| August 17, 1894 | 190,000.00 |
| June 3, 1896 | 45,000.00 |
| Sundry civil act— | |
| June 4, 1897 | 875,000.00 |
| July 1, 1898 | 1,420,720.00 |
| March 3, 1899 | 700,000.00 |
| June 6, 1900 | 1,000,000.00 |
| March 3, 1901 | 975,000.00 |
| June 28, 1902 | 733,230.00 |
| Total | 6,946,746.46 |
| Expended to June 30, 1904 | 5,904,867.55 |
| Balance unexpended July 1, 1904 | 1,041,878.91 |

*Expenditures, Illinois and Mississippi Canal, for fiscal year 1904.*

| | |
|---|---|
| Eastern section, Illinois River to Feeder Junction | $161,008.11 |
| Western section, Feeder Junction to Rock River | 271,427.35 |
| Feeder line | 26,171.22 |
| Total | 458,606.68 |

*Total expenditures, Illinois and Mississippi Canal, to end of fiscal year 1904.*

| | |
|---|---|
| Eastern section | $2,758,771.15 |
| Western section: | |
| Around rapids of Rock River | 547,229.93 |
| Rock River division | 25,470.21 |
| Feeder Junction to Rock River | 1,183,920.70 |
| Feeder line | 1,389,475.56 |
| Total | 5,904,867.55 |

LIST OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1904.

| Name and address of contractor. | Nature of contract. | Date. | To expire— | Remarks. |
|---|---|---|---|---|
| Pound Construction Co., Chicago, Ill. | Earthwork, mile 34, western section, Illinois and Mississippi Canal. | Sept. 1, 1900 | Sept. 30, 1901 | Contract annulled Nov. 12, 1902. |
| T. W. Kinney & Sons, Terre Haute, Ind. | Earthwork miles 30-32, western section, Illinois and Mississippi Canal. | May 10, 1901 | Dec. 31, 1901 | Time limit waived. |
| Katz & Callahan, Omaha, Nebr. | Earthwork, mile 46 and new channels. | ....do | ....do | Time limit waived. Completed Aug. 20, 1903. |
| John J. [illegible], Chicago, Ill. | Earthwork, miles 29, 30, and 31, western section. | Sept. 12, 1901 | Oct. 15, 1902 | Time limit waived. Completed June 1, 1904. |
| Katz & Callahan, Omaha, Nebr. | Earthwork, mile [illegible], western section. | ....do | Oct. 30, 1902 | Time limit waived. Completed Oct. 7, 1903. |
| Chicago Bridge and Iron Co., Chicago, Ill. | Superstructure of highway bridges. | Mar. 27, 1902 | Dec. 31, 1902 | Time limit waived. Completed Dec. 21, 1903. |
| Wallace [illegible], Lafayette, Ind. | Superstructure of highway bridges. | Apr. [illegible], 1902 | ....do | Time limit waived. Completed Dec. 12, 1903. |

LIST OF CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1904—Continued.

| Name and address of contractor. | Nature of contract. | Date. | To expire— | Remarks. |
|---|---|---|---|---|
| Cogan & Pound, Chicago, Ill. | Pits and foundations for 2 locks and 4 culverts. | Apr. 2, 1902 | Nov. 30, 1902 | Time limit waived. Completed Dec. 2, 1903. |
| Chas. Stone, Des Moines, Iowa. | Pits and foundations for 4 aqueduct bridges. | Mar. 20, 1902 | .....do....... | Contract annulled Aug. 14, 1903. |
| Callahan Bros. & Katz, Omaha, Nebr. | Earthwork, miles 58 and 59, western section. | July 16, 1902 | July 31, 1903 | Time limit waived. |
| Page & Shnable, Chicago, Ill. | Foundations and walls for locks and piers and abutments for bridges. | Aug. 11, 1902 | Nov. 30, 1904 | |
| Chicago Bridge and Iron Co., Chicago, Ill. | Superstructure, 4 highway bridges. | July 10, 1903 | Dec. 31, 1903 | Do. |
| Savage Construction Co., Chicago, Ill. | Pits and foundations for 4 aqueduct bridges. | Oct. 12, 1903 | Sept. 30, 1904 | |
| Callahan Bros. & Katz, Omaha, Nebr. | Earthwork, miles 53–57, western section. | Apr. 16, 1904 | Nov. 1, 1905 | |
| Marquette Cement Manufacturing Co., Lasalle, Ill. | Furnishing 4,000 barrels Portland cement. | May 2, 1904 | ............... | |
| Wisconsin Bridge and Iron Co., Milwaukee, Wis. | Superstructure of 1 single track steel railroad bridge. | June 9, 1904 | Oct. 1, 1904 | |
| Winston Bros. Co., Minneapolis, Minn. | Earthwork, parts of miles 34 and 60, western section. | June 21, 1904 | Nov. 30, 1904 | Work to begin on or before July 1, 1904. |
| A. E. Morton, Mineral, Ill. | Removing cross banks and building embankments at highway bridge sites, western section, Illinois and Mississippi Canal. | .....do....... | .....do....... | Do. |

## REPORT OF MR. L. L. WHEELER, ASSISTANT ENGINEER.

STERLING, ILL., *June 30, 1904.*

CAPTAIN: I have the honor to submit the following report upon the work done on the Illinois and Mississippi Canal under my supervision during the fiscal year ending June 30, 1904.

### FEEDER.

During the year 4,170 cubic yards of rock were excavated in mile 1 and loaded by hand into cars. The greater portion of this rock was crushed and hauled by train to the aqueduct bridge over Green River and to the sites of the various highway bridges along the feeder, from numbers 51 to 60. A total of 2,520 cubic yards was delivered at the aqueduct site and 3,040 cubic yards at the various bridges.

Sand and gravel was loaded from the waste banks along the feeder and hauled by cars to the various sites. A total of 2,240 cubic yards was hauled to the aqueduct site and 1,760 cubic yards to the various bridges.

During the year a new set of plans was drawn for the aqueduct crossing Green River, which included an emergency gate of the Desfontaines type at each end of the aqueduct. Work upon the aqueduct commenced this spring by the moving to the site of an office and warehouse. Piles and pine timber for foundations have been purchased, and all except a small number of the piles delivered at the site. It is planned to inclose each abutment and one pier in an inclosure on each side of the river and complete these structures, after which the two intermediate piers in the river are to be inclosed by a cofferdam and the masonry constructed. At present the cofferdams on each side of the river have been built, the pit on the north side of the river excavated, and the pit on the south side about 75 per cent excavated. In all, about 7,900 cubic yards of earth has been excavated by teams. The stage of the water in Green River has been very favorable for this work.

During the year no progress has been made either in the design or construction of the dam across Rock River at the head of the feeder. The Sterling Hydraulic Company claim that they will be largely damaged if the dam is constructed at the site proposed, and have employed an engineer to prepare a report upon the matter. He

[illegible]

tions for the columns supporting the main truss are 7 feet square and 5 feet below the level of the towpath. In front of these foundations slope paving of Portland cement concrete was laid. The columns themselves are 21 feet 6 inches high, 5 feet square at the base and 3 feet square at the top, and have a slight projecting coping. In each corner of the columns was embedded a 30-pound steel rail, which reached down well into the foundation. The building of railings and finishing of the remaining approaches is now in progress, and will complete all of the highway bridges on the western section except three passing over the tail bays of locks.

At the beginning of the year work upon the arch of culvert 37 was in progress. This culvert was completed and the masonry of culvert 38 was built. Back filling was done over both of these culverts and the slope paving laid. This completes the work on culverts under my supervision. All the culverts were examined and cleared of ice in the spring. The culverts have been subjected to heavy runs of ice and large floods and have so far fulfilled all requirements. At a point on mile 51, a small drainage stream was not provided for by a culvert, but taken directly into the canal. It was found that on account of the lowered outlet the stream was eroding its banks and bringing sand into the canal. A concrete intake was built 12 feet wide, and no further trouble has been experienced.

Miles 53 to 57, inclusive, were cross sectioned, volumes of earthwork computed, the work advertised for contract, and contract awarded to Callahan Brothers & Katz. Work has commenced under this contract and about 30,000 cubic yards of earthwork executed. Work has been in progress by the same firm on the earthwork for miles 58 and 59 and about 141,000 cubic yards contract for earthwork on mile 31. J. J. McCaughey also completed his contract for earthwork on miles 29, 30, and 32. The contract of the Pound Construction Company for earthwork on mile 34 was canceled, the work readvertised, and contract entered into with Winston Brothers for the completion of that mile. The same firm also entered into a contract for the earthwork for a part of mile 60. T. W. Kinser & Sons resumed work under their contract for earthwork on miles 50, 51, and 52, and executed about 65,000 cubic yards. The force employed by them is entirely insufficient to complete their contract the present season.

Work has been in progress during the year under the contract of Page & Shnable for the construction of foundations of locks and the walls of locks and aqueducts. The walls of Lock 24 were built, the back filling done, and slope paving at the lower end laid. The slope paving at the upper end still remains to be laid. The walls at Lock 25 were built, the back filling done, and the slope paving at lower end laid. The walls for Lock 26 have been built and back filling is in progress. The pit for Lock 27 has been excavated, piles driven, and part of the grillage timbers placed. The pit for Lock 28 has been excavated, concrete deposited in foundations where necessary, and the erection of forming for east wall commenced. A small amount of excavation has been done at Lock 29.

Work under the contract of Cogan & Pound for the excavation of pits and construction of foundations for 4 culverts and 2 locks was progressing at such an unsatisfactory rate that possession was taken of the work October 1, and the contract completed by hired labor and the purchase of material. The contract was completed in October and November and a final estimate given.

An agreement had been entered into with the Chicago, Rock Island and Pacific Railway Company for the raising of their tracks at Colona, where it crosses the canal, and the building of the masonry and superstructure of the bridge. Raising of the grade necessitated the raising of their bridge over Green River east of Colona. The track raising has been done, the masonry abutments built, and the superstructure erected. There remains to be done the building of the retaining walls and some concrete masonry for their bridge over Green River.

During the year an agreement was entered into with the Chicago, Burlington and Quincy Railroad Company in regard to the erection of a bridge for this company at Colona. Plans for the superstructure were drawn by the railroad company and the superstructure contracted for. Plans for the masonry were drawn in this office and approved by the railroad company. The south abutment and the foundation for the north abutment have been built, and the building of the north abutment is now in progress. The site for this bridge is in comparatively low ground adjacent to higher ground, with the ground water practically at the surface of the ground. Borings showed that rock was to be met at from 12 to 18 feet below the surface of the ground, while the depth of excavation for the canal was about 10 feet. As the distance to rock below the bottom of excavation was too short to justify driving piles, it was decided to carry the foundations down to rock. The bridge is to be built on a new location a short distance east of the present tracks. On account of the proximity of the tracks and the amount of sand and water to be encountered, it was not considered advisable to dig an open pit for constructing the foundations. Triple-lap sheet piles, with cast-iron points, were driven to rock on the neat lines of the foundations. The earth was then excavated within the sheet piles partly by shovels and partly by sand pump, the sheet piles being shored inside as the excavation progressed. No trouble was experienced from leakage, except through the bowlders and gravel lying on top of the rock. The concrete was deposited on the rock and immediately against the sheet piles, the shores being withdrawn as the concrete was deposited. After the concrete had set the sheet piles were drawn and used for the second foundation. Upon the completion of the second foundation they were again withdrawn and piled again for possible further use.

At the beginning of the year excavation by means of steam shovel and cars was in progress on miles 60 and 61. On part of mile 61 so much mud and water was met that it was found extremely difficult to sustain the shovel while at work. On this account a contract was entered into with Callahan Brothers & Katz for the excavation of shallow cutting on miles 61 and 62, and under this contract about 78,000 cubic yards were excavated. The work is practically finished, except some dressing of slopes. Work was continued with the steam shovel until about December 1, when work was suspended for the winter. Steam-shovel work has not been resumed this year on account of being unable to pass the Chicago, Burlington and Quincy Railway. In all, a total of 162,000 cubic yards were excavated by steam shovel and loaded on train and hauled to form embankments of miles 61 and 62.

During the year I have been assisted by Junior Engineers A. O. Rowse, M. G. Barnes, Fred W. Honens, J. B. Bassett, H. E. Reeves, C. M. Waters, and by the following persons employed in clerical capacity: W. D. Powers, Miss G. A. Deyoe, and Miss M. E. Ladd. I am indebted to all these persons for faithful performance of duties assigned them.

Very respectfully, your obedient servant,

L. L. Wheeler,
*Assistant Engineer.*

Capt. C. S. Riché,
*Corps of Engineers.*

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### REPORT OF MR. JAS. L. LONG, ASSISTANT ENGINEER.

Wyanet, Ill., *July 10, 1904.*

Captain: I have the honor to submit the following report on work done under my supervision on the eastern section Illinois and Mississippi Canal during the fiscal year ending June 30, 1904:

#### MAINTENANCE.

The right-of-way fence has been rebuilt in a number of places where it had been damaged by high water and other causes.

The temporary farm bridge placed on the upper end of Lock 1 was no longer needed, and it was removed and the material therein stored at Lock 3. The one placed over the canal on the upper end of Lock 2 was carried away by floating ice; the wreck was secured and the material stored at Lock 3.

A timber-and-plank bulkhead was built on the upper miter sill of Lock 3 and the culvert openings in the lock walls closed with sliding gates to stop the flow of water through the canal prism and prevent the widening of the crevasse in the towpath embankment on this level near Lock 4.

The reach of water between Locks 3 and 4 was subjected to the severest test of any part of the eastern section when ice went out of Bureau Creek in March. A gorge of ice formed and raised the water to within 11 inches of the top of the embankment, and had it not been for the prompt action of the laborers employed to patrol the banks a number of crevasses would have been made. A crevasse about 110 feet in length was made through the towpath embankment 1,000 feet east of Lock 4, where water was first discovered pouring through a muskrat hole extending through the embankment. The water was so high on the outside and the ground frozen to such a depth that a trench could not be dug in time to intercept it before it was beyond control.

At aqueduct No. 1 the floods bring down a large amount of timber and other débris which catches on the abutments and at times forms almost a complete dam from the girders to the bottom of the creek. This has been kept open by having a force of laborers working while the water was high, as the débris could then be loosened and floated out under the aqueduct.

On mile 5, south of highway bridge No. 2, some necessary repairs were made to the approach of the bridge over Bureau Creek, as it had become impassable for teams.

On mile 7 ramps were graded over the approaches to highway bridge 3, to connect the towpath with the bridge. A protection levee was graded from the lower end of Lock 6 to the railroad embankment, on the west side, with cross-over ramps.

On mile 8 the ditches leading from culverts and seep ditches had not been cleaned out for several years and had become obstructed with débris, causing adjoining land to be overflowed during times of flood, causing much complaint from landowners. These were all cleaned out and good drainage provided for.

On mile 9 the encroachment of Bureau Creek had partly carried away the towpath. This was repaired, the material being hauled from the Owl's Head cut on cars by horses.

On mile 10 the road was graded from the highway to the towpath near bridge 5, giving access to the right of way from the public road.

On mile 12 Bureau Creek had begun to wash away back filling on the north side of Lock 12. It was therefore necessary to reenforce the embankment and riprap it with stone.

The original plan for Lock 12 did not provide for a spillway, so one was constructed by making an opening through the lock wall between the upper gate and the upper end of the lock.

On mile 15 the channel of West Bureau Creek was changed so it would flow straight under aqueduct 3. In its old course it had washed away part of the embankment facing the west approach. This was replaced and a stone revetment laid in cement to protect it.

The narrow-gauge railroad track between Locks 5 and 6 has been taken up and the material stored near Lock 19. From Lock 19 west as far as the end of the track it has been kept in repair for the operation of trains in conjunction with the work on mile 20.

The telephone line has been overhauled from time to time and kept in good condition.

### CONSTRUCTION WORK.

Highway bridges 11, 12, 13, 14, 15, 16, 17, and 18 have been completed with the exception of the approaches to bridge 14.

*Mile 19.*—The temporary wagon road around bridge 12 was removed and the grillage and concrete foundation for a cast-iron pipe drain under the bridge was partly removed.

The drainage ditch in the bottom of the canal was cleaned out and enlarged from bridge 12 to the end of the mile.

All of the slopes of the canal excavation which had been left in an incomplete condition by the Globe Construction Company were dressed, soiled, and seeded.

The head walls and facing to the two cast-iron pipe intakes on the north side, which had been partly washed away, were replaced.

*Mile 20.*—A drainage ditch was excavated in the bottom of the canal, extending to the end of the work done by the Globe Construction Company.

A railroad track was laid from the main line on the towpath into the bottom of the canal, over which was hauled the material excavated to clean up about 700 linear feet of the canal prism.

The intakes that had been made as far as the Globe Construction Company had excavated were completed with head walls and paved aprons, over which the water was discharged into the canal.

The drainage ditch to drain Cecils Slough, which began at the end of the Globe Construction Company's work, was continued through this mile, through miles 21 and 22, as far as bridge No. 14, and a wagon road made through the entire slough.

The project to make the excavation through Cecils Slough with duplex overhead cableway conveyors was approved, material for their construction and track on which to move them, together with 600 tons of coal for operating them, was purchased and delivered at Wyanet, where it was transferred to the Government railroad and transported to mile 20. The towers were built by hired labor; work was begun in October and in February they were ready to be put in operation. The machinery was purchased from the Lidgerwood Manufacturing Company, of New York, and put in place under their supervision.

The cableway plant consists of two movable towers, each 57 feet above the car trucks, with a base about 45 feet square, resting on 24 pairs of standard-gauge car wheels and trucks, which move on five 60-pound steel rails.

The towers are placed 525 feet apart, and from the top of each are suspended two main cables, 2¼ inches in diameter. On these cables the conveyors travel, each carrying a 1¼ cubic yard Haywood orange-peel bucket that excavates the material from the prism of the canal and deposits it on the waste banks 75 feet from the surface slope stakes. The conveyor is moved back and forth on the main cable by a seveneighths-inch endless wire cable, which passes over pulleys on the tail tower and is wound onto a drum on the head tower. The bucket is lowered and hoisted by another three-fourths-inch cable attached to the bucket and wound around a drum, and opened by another three-fourths-inch cable attached to the closing pulleys. These cables are all held in position by trailers which separate them. The trailers are picked up by a horn attached to the conveyor, when it is drawn in, and distributed again at regular distances by buttons on the cable as it is run out. By this appliance the cables are kept from fouling when the heavy strain of loading the buckets is put on them, or relaxation when the load is dumped.

All movements of the conveyor and bucket are controlled by levers. A 125-horsepower steam engine is used to operate each machine, applied with double engines having reversible-link motion. Machinery for operating one conveyor is placed in each tower, so that it serves as both head and tail tower.

The estimated weight of each tower, including machinery, cables, buckets, and ballast, is 80 tons. They are moved by block and tackle on tracks parallel to the canal, and the fall of tackle cable is wound on a winch attached to the shaft of the hoisting drum. They are moved whenever the material is all excavated under the cables. Each move is 6 feet, the width of the cut of the bucket.

It is claimed that a bucket holds 1½ cubic yards of ordinary earth, but in the kind of material these machines are used in takes more. One bucketful, actually measured, contained 2.36 cubic yards. The loads will run from 2 to 2½ cubic yards, and the machines average forty trips per hour, including the time consumed in moving towers and ordinary adjusting of machinery. They have been worked up to 65 trips per hour for a short time.

While the towers were being erected roadbeds for the cableway tracks were graded on each side to the top of Olsons Hill, and have since been extended entirely over the hill.

These are about 45 feet top width, and on passing over the hill a 2 per cent grade was used. The necessary buildings for warehouse and shops were moved from Locks 6 and 19.

The cableways have been operated since April 1, commencing on mile 20, where the Globe Construction Company left off, and made a partial cut for about 850 feet, to the foot of Olsons Hill, not completing the excavation of the canal trunk as they went, on account of there being too great a flow of water in the drainage ditch and the tendency of the north slope to slide into the opening. The towers were moved back, after reaching the hill, to where they began and cleaned up the reach of canal first gone over.

While making excavation through this slough a steam pump of 8-foot capacity is operated to reduce the water to the grade of the bottom of the canal. Another small steam pump is also operated to supply the towers with water.

That part of the canal known as Olsons Hill is composed of clay that is too hard to move by the Hayward buckets, so it is taken out with wheeled scrapers, as that method is more economical than if done by the cableways.

About 124,636 cubic yards was excavated on this mile during the year.

*Mile 22.*—The east half of this mile lies in the peat marsh of Cecils Slough with an average cut of 17 feet and will require 148,000 cubic yards of excavation, which will be done by the overhead cableway.

The west half of the mile passes through a hill with a minimum cut of 11 feet and a maximum cut of 36 feet, requiring 271,600 cubic yards of excavation, of this amount 89,748 cubic yards in the heavy cutting has been taken out by wheeled scrapers, and a western grader drawn by a traction engine, and dump wagons, operated by hired labor. Of the lighter cutting, 7,949 cubic yards have been taken out by a turntable dredge that is also operating on mile 23 by hired labor.

*Mile 23.*—This mile is located in a small valley locally known as Hornbys Slough, where the cut is almost uniformly 11 feet. The material excavated consists of alternate pockets of peat, muck, gravel, and quicksand. At the end of the last fiscal year no work had been done on this mile other than the excavation of a small ditch along the center line, 4,500 feet in length for surface drainage.

During this year a number of trees have been grubbed, a road constructed for construction purposes, and 98,705 cubic yards of earth excavated from the canal prism.

A Kearns patent turntable dredge, having a 65-foot boom and operating a 1¼ cubic yard orange-peel bucket, was purchased in October for this work and has been operated twenty-four hours per day since the 1st of November, excepting a period of fifty days, from February 10 to April 1, while repairing the damage done by fire; the first fifteen days of November, when operated only one shift, and from the 15th of November to December 31, when operated two shifts only.

Of the excavation done on this mile 5,630 cubic yards on the west and where inaccessible with dredge was done with teams.

*Mile 24.*—At the end of the last fiscal year the earthwork on this mile was complete except the removal of about 2,000 cubic yards of peat that was forced up from the bottom of the canal by the weight of the banks. This has been removed so far as the stage of water permitted at the time it was undertaken. A small part of it then under water remains to be excavated. About 1,500 linear feet of canal slope on the east end of this mile, on which grass had failed to grow and which had become much eroded, was resoiled and seeded.

The earthwork done on this mile during the year was about 3,000 cubic yards.

*Mile 25.*—The earthwork on this mile is now complete, except a small gap left in one bank for temporary drainage. The earthwork on this mile for the year was 7,300 cubic yards.

*Mile 26.*—The earthwork done on this mile during the year consisted of the removal of the temporary roadway across the canal at bridge 16 and the filling of a small gap in one bank previously used for drainage, altogether about 500 cubic yards. The earthwork on this mile is now complete.

*Mile 27.*—The earthwork done on this mile during the year consisted of the removal of the temporary roadway at bridge 17 and the excavation under this bridge, about 1,500 cubic yards, all earthwork now being complete.

*Mile 28.*—The earthwork done on this mile during the year consisted of the filling of two gaps in the canal banks, previously used as a temporary roadway.

Constructed a 48-inch pipe culvert with concrete head walls and rubble splay walls under the north approach to bridge 17, as an auxiliary waterway to the arch culvert under the same approach.

The abutments of bridge 18, due to having been built upon an unstable foundation, had tipped forward, the south abutment 12 inches and the north abutment 6 inches at the top. The earth was removed from behind the south abutment and the abutment pulled back to a vertical position and anchored to a heavy concrete deadman, constructed in the approach 52 feet behind the face of the abutment with rods and turnbuckles. The north abutment was anchored in a similar manner.

A lock keeper's dwelling, to be used temporarily as an office by the junior engineer in charge of the overhead cableway conveyors, has been constructed near Lock 21.

In conclusion I desire to thank the following employees for faithful and efficient service: Junior Engineers S. L. Bayless and Joseph Wright, Clerk C. F. Scott, assisted by F. L. Carter, recorder.

Very respectfully, your obedient servant,

Jas. C. Long,
*Assistant Engineer.*

Capt. C. S. Riché,
*Corps of Engineers.*

# APPENDIX M M.

## IMPROVEMENT OF MICHIGAN CITY HARBOR, INDIANA, AND OF RIVERS AND HARBORS ON THE EASTERN SHORE OF LAKE MICHIGAN.

## *REPORT OF COL. M. B. ADAMS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. Harbor at Michigan City, Indiana.
2. St. Joseph Harbor and River, Michigan.
3. Harbor at South Haven, Michigan.
4. Harbor at Saugatuck and Kalamazoo River, Michigan.
5. Harbor at Holland (Black Lake), Michigan.
6. Harbor at Grand Haven, Michigan.
7. Grand River, Michigan.
8. Muskegon Harbor, Michigan.
9. Harbors at Pentwater and White Lake, Michigan.
10. Harbor at Ludington, Michigan.
11. Harbor at Manistee, Michigan.
12. Harbor of refuge at Portage Lake, Michigan.
13. Frankfort Harbor, Michigan.
14. Harbor at Charlevoix, Michigan.
15. Harbor at Petoskey, Michigan.

### EXAMINATIONS AND SURVEYS.

16. Arcadia Harbor, Michigan.
17. Charlevoix Harbor, Michigan.
18. South Haven Harbor, Michigan.

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UNITED STATES ENGINEER OFFICE,
*Grand Rapids, Mich., July 19, 1904.*

GENERAL: I have the honor to submit herewith the annual report of works of river and harbor improvement under my charge for the fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

M. B. ADAMS,
*Colonel, Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

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## M M 1.

## IMPROVEMENT OF HARBOR AT MICHIGAN CITY, INDIANA.

mprovement is brought to the beginning of the
of the Chief of Engineers for 1903, pages

## OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

The property stored at this harbor has been cared for by the watchman who is employed for this purpose, and who also maintains the pier lights. The Light-House Establishment has thus far made no provision for lighting the harbor structures, but has loaned four lens lanterns, which are maintained at the expense of the appropriation for this harbor.

Work under the continuing contract of Stebbings & Wenzell for the extension of the breakwater pier and the construction of the new detached breakwater was finally completed on June 10, 1904. A detailed statement of the operations during the year is as follows: The construction of the remaining cribs for the detached breakwater was completed, the foundation of cribs 11, 12, and 13 was adjusted to the proper level, and crib 11 was sunk in its place on July 16, crib 12 on August 3, and crib 13 on August 18. Cribs 3 to 13, which had settled somewhat irregularly, were leveled up to the specified elevation of +2 feet, and the superstructure, 6 feet high, was built on them. The upper four courses remained uncompleted for about 250 feet during the winter, and considerable damage was done to this part of the work by the sea, but repairs were made after the resumption of operations and the superstructure was completed. The space between the projecting horns above water at both ends of the breakwater was filled with a solid timber construction, oak mooring posts were built into the work at distances of 50 feet, the stone filling was completed and the decking was secured in place. About 620 cords heavy stone were added to the riprap on the lake face and on 50 feet of the land face at each end. The length of the detached breakwater is 1,303.8 feet, and its height above zero of gauge is approximately 8 feet.

The removal of the remainder of the old detached breakwater was completed in September. The contractors secured from it an additional quantity of about 580 cords of stone, which they used in filling the new breakwater. The date of the completion of the contract was June 10.

Operations under the contract with Robert Millen & Co. for repairing the west entrance pier between stations 16+20 and 21+58, and the east entrance pier between stations 6+70 and 14+05, and for closing the entrance to the outer basin, were continued. The work on the west pier was as follows: A trench was dredged along the face of the work for the removal of obstructions. The front guide timber was put in place from station 18+01.2 to station 16+41.8 and the rear guide from station 21+58.8 to station 21+09; 47 compound sheet piles were driven in the rear wall, station 21+58.8 to station 21+09, 19 at the outer end and 390 in the front wall, station 21+58.8 to station 17+55.1. The upper binder was secured in place on the sheet piles in the rear and end walls and in the front wall from station 21+59 to station 19+29, and the lower binder on the rear and end walls, and in the front wall from station 21+59 to station 20+29. Thirteen round piles were driven in the rear wall from station 21+60.5 to station 21+10.5, 8 in the end wall and 102 in the front wall from station 21+60.5 to station 17+54.5. The outer wale was secured in the rear wall from station 21+61.8 to station 17+47 in the end wall, and in the front wall from station 21+61.8 to station 19+38.5, and 27 tie-rods were put in place from station

21+52.5 to station 19+41.7. The superstructure was built in the first course from station 21+60.8 to station 18+35.5 in the front wall, and to station 17+34.3 in the rear wall, and in both walls, commencing at the outer end, station 21+60.8, the second course to station 18+45.5, the third course to station 18+59.5, the fourth course to station 19+31.5, the fifth course to station 19+41.5, and the sixth course to station 19+55.5. Sixty-three and seven-tenths cords stone were placed in the new work between stations 21+59.8 and 21+13, of which quantity 45 cords had been recovered from a shoal near the west pier. The end of the pier, which was originally at station 21+58, was moved out to station 21+60.8 by the addition of the new sheet and round piles in the end wall. A cluster of 13 piles was driven near the outer end of the pier for the protection of the pier. The piles are drawn together at the top by five turns of 1-inch wire rope. In the east pier the old timbers above grade were removed between stations 12+85.5 and 10+36.5. A trench was excavated along the face of the old pier between stations 14+05 and 7+75 for the removal of obstructions. When this trench was extended past station 7+75 the old cribs, which have only a small depth, slid forward into the channel, and it became necessary to remove the old work between stations 7+75 and 6+70 entirely, and to substitute for the original plans for its repair those adopted for the structure closing the entrance to the old basin. A similar change was found necessary, as far as the front wall was concerned, in consequence of the storm of April 15, which tore out the old front wall between stations 10+84 and 11+58 and ruined the same as far as station 12+78, thereby destroying the support for the sheet piles formerly existing and upon which the plans were based. Eighty round piles were driven in the front row station 14+01 to station 10+85.5, and 18 round piles from station 7+73.5 to station 7+05.5, and 21 round piles were driven in the rear row station 7+73.5 to station 6+93.5. The guide was put in place from station 14+05 to station 11+78.5, and 212 compound sheet piles were driven from station 14+04.6 to station 11+83 and secured by the upper binder between stations 14+05 and 11+86.5 and by the lower binder between stations 13+90 and 12+26.5. The front wale was secured in place from station 14+05 to station 11+73.5, the rear wale from station 13+90 to station 12+88.5, and 27 tie-rods from station 13+89.5 to station 11+83.7. The superstructure, commencing at station 13+90 was built to station 11+80.5 in the front wall and to station 9+80.8 in the rear wall in the first course; to station 11+88.5 in the front wall and to station 11+96.5 in the rear wall in the second course; and in both walls to station 11+96.5 in the third course; to station 12+04.5 in the fourth course; to station 12+12.5 in the fifth course, and to station 12+20.5 in the sixth course. The old cluster of piles formerly protecting the outer end of this pier was removed. The structure closing the entrance to the old outer basin was practically finished, the only thing remaining to be done being the completion of the stone filling and the plank walk. Ten round front piles and 472 compound sheet piles were driven, the upper and lower guide, binding timber, front and rear wales and tie-rods, and the superstructure, six courses high and extending from station 18+69.5 at the junction with the breakwater pier to station 14+05 at the junction with the outer end of the east entrance pier, were put in place, and about 589 cords stone were distributed as filling behind the sheet piles, of which 79 cords were obtained by the contractor from the trench along the face of the east pier between stations 14+05 and 7+75, and about 100 cords were recovered from the old east pier between stations 7+75 and 6+70.

Much delay and loss by damage through storms was caused to the contractors during the year. On August 26, 26 sheet piles, with the attached guide and binding timbers, were lost from the new closing structure between stations 17 and 16+73. On September 16–17 the end sheet piles of the west pier, with the attached timbers, were torn out; on October 8, 14 sheet piles were lost from the west pier between stations 21+19 and 21+05, and 53 sheet piles from the east pier between stations 14+04 and 13+49, and on April 15 considerable quantities of stone were washed into the channel from the west pier, 76 sheet piles were torn out in the east pier between stations 12+78 and 12+00, the front wall of the old east pier between stations 10+84 and 11+58 was torn out to a depth of 6 to 8 feet below water, and large quantities of stone filling were washed into the channel. Work under this contract was suspended from December 3 to April 11.

Under the contract with the Lydon & Drews Company the channel between the entrance piers was straightened by a cut 30 feet wide and 17 feet deep, the dredged quantity being 4,342 cubic yards. The resulting available depth from the entrance to the first bend was 16 feet. The price per cubic yard was 16.5 cents.

Proposals were opened March 17 for such dredging as may be found necessary for the restoration of the navigable condition of the harbor, and on March 25 a contract was entered into with Samuel O. Dixon, the lowest bidder.

The foregoing operations cost as follows:

| | |
|---|---|
| Construction of breakwaters, under contract with Stebbings & Wenzell.. | $81,570.05 |
| Repair of piers and closing entrance to outer basin, under contract with Robert Millen & Co.......................................... | 29,342.75 |
| Dredging, under contract with the Lydon & Drews Company ........... | 716.43 |

## CONDITION OF WORK, JUNE 30, 1904.

The west entrance pier, as built by the Government, has a total length of 2,160.8 feet, consisting of 1,360.8 feet of pile work and 800 feet of crib work. The inner section of 785 feet was formerly occupied by private parties, but at present no such use is made of it. The inner end for a length of 228 feet is destroyed, the next 386 feet has been rebuilt during recent years by the riparian owners. The outer part of the west pier for a length of 540.8 feet is now under contract to be repaired and sheet piled. The remainder, 1,006 feet in length, is in need of extensive repairs above water and sheet piling to make it sand tight. The east entrance pier, together with the structure across the entrance of the old basin, has a total length of 1,869.5 feet, of which the inner 670 feet is in front of private property and totally wrecked. The section from station 6+70 to station 14+05 is now under contract to be substantially repaired and sheet piled. A city ordinance requires riparian owners to maintain docks or revetments along their water fronts in the inner harbor, but the existing revetments are in bad condition in many places. The breakwater pier, connecting with the structure across the entrance to the outer basin, has a total length of 1,136 feet. It is in good condition. The opening to the outer basin has been closed by a sheet-pile structure. The closing of the basin renders the further maintenance of the old east breakwater and the pile pier inclosing the basin on the east unnecessary, and these structures are to be abandoned. The new detached breakwater has a length of 1,303.8 feet.

The condition of navigation, as shown by soundings of May 5–13 is as follows, the depths being referred to the level of zero of gauge: 21.6 feet opposite the end of breakwater pier; about 200 feet outside of end of west pier a shoal projects in front of the breakwater pier with 15.6 feet depth, 60 feet from face of pier, and deepening to 18.4 feet 100 feet from pier; at outer end of channel between entrance piers, 18 feet in mid-channel and 15.1 feet farther inside; on the shoalest section from Franklin Street Bridge to first angle above Sixth Street Bridge, 14.1 feet; thence to second angle 12.2 feet; and at foot of upper basin, 7.3 feet. The stage of the lake at the time of soundings was —0.4 to —0.8 foot.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The work under contract with Robert Millen & Co. for the repairs of piers and closing entrance to outer basin will be completed. Of the balance remaining available it is proposed to reserve $4,100 as part payment for an inspection steamer and the remainder for the payment of office expenses and contingencies and for such dredging or repairs as may become necessary.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

To complete the approved project there remains 200 linear feet still to be added to the detached breakwater. The estimated cost of this work is $30,000. After the completion of the repairs of the outer 540.8 feet of the west entrance pier there remains an additional length of 1,006 feet which must be maintained by the Government and which is in need of sheet piling and new superstructure. This, estimated at $27.50 per linear foot, will cost $27,665.

A petition, dated October 16, 1903, and signed by the mayor and numerous citizens of Michigan City, has been received requesting a modification of the existing project, which would involve the removal of the portion of the west pier south of the part now undergoing repairs, and the construction of a new pier practically on the line of the remaining outer part, whereby the width of the entrance channel would obtain a uniform width of about 220 feet. In addition it is proposed to widen the harbor at the bend, so as to secure better winding facilities than exist at the present time. This project, if adopted, would require the construction by the Government of about 1,000 linear feet of pier and revetment and the removal of about 180,000 cubic yards of old pier and sand and clay banks.

The dredging during recent years has been on a small scale and there is need of a more general deepening and widening of the inner harbor. The estimate for this purpose is $10,000.

To provide for the repairs of possible damage to the extensive works and for refilling, an estimate of $5,000 is made.

The estimate submitted is therefore—

| | |
|---|---|
| For extending the detached breakwater 200 feet | $30,000 |
| For repairing 1,006 feet of the existing west pier | 27,665 |
| For dredging | 10,000 |
| For general repairs and refilling | 5,000 |
| Total | 72,665 |

Of which the first item is for construction and the other three for maintenance.

| | | | |
|---|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | | $1,539,138.92 |
| Miscellaneous receipts | | | 4,130.00 |
| | | | 1,543,268.92 |
| Less amount carried to surplus fund | | | 5.15 |
| | | | 1,543,263.77 |
| Total amount expended on previous projects from July 4, 1836, to June 30, 1902: | | | |
| For construction | $1,009,507.04 | | |
| For maintenance | 187,084.80 | | |
| | | $1,196,591.84 | |
| Total amount expended to June 30, 1904, on existing project adopted March 3, 1899: | | | |
| For construction | 272,815.16 | | |
| For maintenance | 11,986.99 | | |
| | | 284,802.15 | |
| | | | 1,481,393.99 |
| Balance | | | 61,869.78 |
| Estimated cost of existing revised project | | | 312,150.00 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $169,904.79 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $96,048.02 | |
| For maintenance of improvement | 11,986.99 | |
| | | 108,035.01 |
| July 1, 1904, balance unexpended | | 61,869.78 |
| July 1, 1904, outstanding liabilities | | 271.68 |
| July 1, 1904, balance available | | 61,598.10 |
| July 1, 1904, amount covered by uncompleted contracts | | 49,221.46 |
| Amount (estimated) required for completion of existing project | | 30,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $30,000.00 | |
| For maintenance of improvement | 42,665.00 | |
| | | 72,665.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

| Date. | Outer harbor. | Inner harbor. | Total. |
|---|---|---|---|
| July 4, 1836 | | | $20,000.00 |
| March 3, 1837 | | | 80,000.00 |
| July 7, 1838 | | | 60,733.59 |
| June 11, 1844 | | | 25,000.00 |
| August 30, 1852[a] | | | 20,000.00 |
| March 2, 1855 (claim of J. R. Bowes) | | | 470.83 |
| June 23, 1866 | | | 75,000.00 |
| July 25, 1868 (allotment) | | | 25,000.00 |
| April 10, 1869 (allotment) | | | 51,185.00 |
| July 11, 1870 | $25,000.00 | | 25,000.00 |
| March 3, 1871 | 15,000.00 | | 15,000.00 |
| June 10, 1872 | 50,000.00 | | 50,000.00 |
| March 3, 1873 | 50,000.00 | | 50,000.00 |
| June 23, 1874 | 50,000.00 | | 50,000.00 |
| March 3, 1875 | 50,000.00 | | 50,000.00 |
| August 14, 1876 | 35,000.00 | | 35,000.00 |
| June 18, 1878 | 50,000.00 | $25,000.00 | 75,000.00 |
| 1878 (allotment) | 2,500.00 | | 2,500.00 |

[a] Amount carried to surplus fund, $5.15.

### APPROPRIATIONS—continued.

| Date. | Outer harbor. | Inner harbor. | Total. |
|---|---|---|---|
| March 3, 1879 | $40,000.00 | | $40,000.00 |
| June 14, 1880 | 40,000.00 | $15,000.00 | 55,000.00 |
| March 3, 1881 | 20,000.00 | 25,000.00 | 45,000.00 |
| August 2, 1882 | 60,000.00 | 20,000.00 | 80,000.00 |
| July 5, 1884 | 40,000.00 | 10,000.00 | 50,000.00 |
| August 5, 1886 | 54,375.00 | 1,875.00 | 56,250.00 |
| August 11, 1888 | 90,000.00 | 5,000.00 | 95,000.00 |
| September 19, 1890 | 50,000.00 | 7,500.00 | 57,500.00 |
| July 13, 1892 | 30,000.00 | 15,000.00 | 45,000.00 |
| August 18, 1894 | 20,000.00 | 10,000.00 | 30,000.00 |
| June 3, 1896 | 70,000.00 | 10,000.00 | 80,000.00 |
| March 3, 1899 | | 7,500.00 | 7,500.00 |
| June 6, 1900 | 196,000.00 | | 195,000.00 |
| June 13, 1902 | | | 63,000.00 |
| Miscellaneous receipts | | | 4,130.00 |
| Total | 1,036,875.00 | 151,875.00 | 1,543,268.92 |

### ABSTRACT OF CONTRACTS IN FORCE.

*Construction of breakwaters.*

Contractor: Stebbings & Wenzell.
Date of contract: February 3, 1900.
Date of approval: February 21, 1900.
Date of beginning: May 1, 1900.
Date of expiration: June 30, 1901; changed to December 31, 1901, by supplemental contract dated August 24, 1901; time limit waived. Supplemental contract dated July 19, 1901, provides for use of pine timber in place of hemlock, if desired; supplemental contract dated January 19, 1903, provides for use of Douglas-fir or long-leaf yellow-pine timber in place of white pine in five lower courses of superstructure and for long-leaf yellow pine in uppermost course of side and end walls of superstructure; supplemental contract dated March 24, 1903, provides for 13 cribs in detached breakwater instead of 14, as originally agreed.
Rates: Dredging, $1 per cubic yard; foundation piles, 30 cents per linear foot; white-oak timber, $50 per M feet B. M.; white-pine timber, $30.80 per M feet B. M.; hemlock timber, $24 per M feet B. M.; white-pine decking, $25 per M feet B. M.; driftbolts, screw bolts, and spikes, 4 cents per pound; stone, $7.50 per cord.

*Repair of piers and closing entrance to outer basin.*

Contractor: Robert Millen & Co.
Date of contract: February 27, 1903.
Date of approval: March 21, 1903.
Date of beginning: April 15, 1903.
Date of expiration: January 1, 1904. (Time limit waived.)
Rates: Cutting down and removing old work, $3 per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $40 per M feet B. M.; white-pine, long-leaf yellow-pine, or Douglas-fir timber, $33 per M feet B. M.; white-pine, long-leaf yellow-pine, or Douglas-fir planks for sheet piles, $39 per M feet B. M.; white pine or long-leaf yellow pine for decking, $30 per M feet B. M.; driftbolts, 2½ cents per pound; screw bolts and tie-rods, 3 cents per pound; carriage bolts and spikes, 4 cents per pound; stone, $6.50 per cord.

*Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16¾ cents per cubic yard.

Contractor: Samuel O. Dixon.
Dated: March 25, 1904.
Approved: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17¾ cents per cubic yard.

COMMERCIAL STATISTICS FOR MICHIGAN CITY HARBOR,
ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by Mr. James Wooden,
City, Ind.]

| Character of vessels. |
|---|
| Steam |
| Sail |
| Total |

Maximum draft, 15.3 feet in inner harbor to lower basin and

*Receipts by vessel,*

| Articles received. | Tons. | [illegible] |
|---|---|---|
| Apples and potatoes | 55 | Ties and |
| Lumber | 98,500 | Wood |
| Salt | 5,432 | |
| Shingles | 907 | Total |

NOTE.—No record is kept of traffic between Michigan

Total freight carried in 1902
Total freight carried in 1903

Decrease

---

M M

IMPROVEMENT OF ST. JOSEPH

The history of these works to the
the Report of the Chief of Engine
in the Report of the Chief of Engi

(A) ST.

*Operations during fiscal*
Drews Company, contractors
their work on October 6.
as follows: In the north
pleted and the remainder
was put in place. About
the outer end of the pier
completed to the outer
feet apart, were built
end were secured in pl
put on between station
rapped with about 6
extending the north

The Chicago and
tractors for repair
and for refilling
south pier b

*Money statement.*

| | | |
|---|---|---|
| | | $97,026.61 |
| during fiscal year: | | |
| | $43,315.69 | |
| | 17,220.61 | |
| | | 60,536.30 |
| | | 36,490.31 |
| | | 63.71 |
| | | 36,426.60 |
| by uncompleted contracts | | 21,779.89 |
| expended in fiscal year ending June 30, improvement, in addition to the balance unex- | | 20,000.00 |

requirements of sundry civil act of June of the river and harbor act of 1899.

ST. JOSEPH RIVER.

| | | |
|---|---|---|
| and allotted to June 30, 1904 | | $6,250.00 |
| to June 30, 1904: | | |
| | $4,555.49 | |
| | 944.51 | |
| | | 5,500.00 |
| | | 750.00 |

*Money statement.*

| | |
|---|---|
| unexpended | $750.00 |
| unexpended | 750.00 |
| profitably expended in fiscal year ending June 30, of improvement, in addition to the balance un- 1904 | 750.00 |

with requirements of sundry civil act of June section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

*St. Joseph Harbor and River, Michigan.*

| | | | |
|---|---|---|---|
| | $20,000.00 | June 18, 1878 | $12,000.00 |
| | *15,000.00 | March 3, 1879 | 6,000.00 |
| | 51,113.00 | June 14, 1880 | 8,000.00 |
| | 25,000.00 | March 3, 1881 | 10,000.00 |
| | 20,000.00 | August 2, 1882 | 12,000.00 |
| | 10,000.00 | July 5, 1884 | 15,000.00 |
| (allotment) | 15,000.00 | August 5, 1886 | 10,000.00 |
| | 6,000.00 | August 11, 1888 | 12,000.00 |
| | 23,000.00 | September 19, 1890 | 20,000.00 |
| har- North- Lakes, $7,500.00 | | July 13, 1892 | 59,000.00 |
| | | August 18, 1894 | 30,000.00 |
| | | June 3, 1896 | 30,000.00 |
| | | March 3, 1899 | 50,000.00 |
| in 1870 Haven | | June 6, 1900 | 253,950.00 |
| | | March 3, 1901 | 38,000.00 |
| 500.00 | | June 13, 1902 (allotment) | 23,250.00 |
| | 7,000.00 | Miscellaneous receipts | 1,027.15 |
| 1, 1870 | 15,000.00 | | |
| 3, 1871 | 10,000.00 | Total | 859,340.15 |
| 10, 1872 | 3,000.00 | Amount carried to surplus fund, 1856 | .80 |
| 1874 | 2,000.00 | | |
| 1875 | 35,000.00 | | |
| 14, 1876 | 12,000.00 | Balance | 859,339.35 |

*Condition of work June 30, 1904.*—The total length of the north pier and revetment is 2,854 feet, consisting of 2,183.5 feet crib work and 670.5 feet pile work. At the east end a pile wing 165 feet long connects with the dock of the United States light-house depot. The south pier is about 2,623 feet long and consists of 1,803 feet crib work and 820 feet pile work. All these structures are in excellent condition except the wing at the east end of the north pier, the filling of which is not in good condition.

### (B) ST. JOSEPH RIVER.

No work was done during the fiscal year, as the depth of channel was sufficient for the requirements of vessels navigating the river.

*Work proposed for fiscal year ending June 30, 1905.*—The dredging now in progress will be completed and the amount estimated required for its payment is about $9,000. Of the balance remaining available, $10,000 is reserved as part payment of the hydraulic dredge now under construction, $1,500 as part payment of an inspection steamer, and the balance is to be reserved for contingencies and such additional dredging and incidental repairs as may become necessary.

With the funds available for St. Joseph River it is proposed to do such work as may be needed to restore the 3-foot channel of the approved project.

*Estimate of funds for fiscal year ending June 30, 1906.*—All new construction work under the authorized project has been completed and the existing structures on the entrance channel are in serviceable condition. The soundings of April 26 to May 2 show that the interior channels have considerably deteriorated since the general dredging of 1901. The accretions of sand causing this deterioration are brought down by the St. Joseph and Pawpaw rivers when in flood, and as this is a matter of annual recurrence, it follows that dredging for the restoration of the required widths and depths of channel may be expected to be necessary every year. The amount estimated required for this purpose and for incidental repairs for one year is $10,000, or for two years $20,000. The estimate for St. Joseph River is $750. The total amount of the estimate is therefore $20,750.

#### ST. JOSEPH HARBOR.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $858,313.00 |
| Miscellaneous receipts | | 1,027.15 |
| | | 859,340.15 |
| Less amount carried to surplus fund | | .80 |
| | | 859,339.35 |
| Total amount expended July 4, 1836, to March 3, 1899: | | |
| For construction | $336,479.50 | |
| For maintenance | 166,633.73 | |
| | | 503,113.23 |
| Total amount expended on project approved March 3, 1899: | | |
| For construction | 284,876.50 | |
| For maintenance | 34,859.31 | |
| | | 319,735.81 |
| Balance | | 36,490.31 |
| Estimated cost of revised project approved March 3, 1899 | | 358,000.00 |

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $97,026.61 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $43,315.69 | |
| For maintenance of improvement | 17,220.61 | |
| | | 60,536.30 |
| July 1, 1904, balance unexpended | | 36,490.31 |
| July 1, 1904, outstanding liabilities | | 63.71 |
| July 1, 1904, balance available | | 36,426.60 |
| July 1, 1904, amount covered by uncompleted contracts | | 21,779.89 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | | 20,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

#### ST. JOSEPH RIVER.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $6,250.00 |
| Total amount expended 1888 to June 30, 1904: | | |
| For construction | $4,555.49 | |
| For maintenance | 944.51 | |
| | | 5,500.00 |
| Balance | | 750.00 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $750.00 |
| July 1, 1904, balance unexpended | 750.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 750.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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#### APPROPRIATIONS.

*St. Joseph Harbor and River, Michigan.*

| | | |
|---|---|---|
| July 4, 1836 | | $20,000.00 |
| March 3, 1837 | | *15,000.00 |
| July 7, 1838 | | 51,113.00 |
| March 3, 1843 | | 25,000.00 |
| June 11, 1844 | | 20,000.00 |
| August 30, 1852 | | 10,000.00 |
| June 28, 1864 (allotment) | | 15,000.00 |
| June 23, 1866 | | 6,000.00 |
| March 2, 1867 | | 23,000.00 |
| Allotted from harbors on Northwestern Lakes, 1867 | $7,500.00 | |
| Transferred in 1870 to Grand Haven Harbor | 500.00 | |
| | | 7,000.00 |
| July 11, 1870 | | 15,000.00 |
| March 3, 1871 | | 10,000.00 |
| June 10, 1872 | | 3,000.00 |
| June 23, 1874 | | 2,000.00 |
| March 3, 1875 | | 35,000.00 |
| August 14, 1876 | | 12,000.00 |
| June 18, 1878 | | $12,000.00 |
| March 3, 1879 | | 6,000.00 |
| June 14, 1880 | | 8,000.00 |
| March 3, 1881 | | 10,000.00 |
| August 2, 1882 | | 12,000.00 |
| July 5, 1884 | | 15,000.00 |
| August 5, 1886 | | 10,000.00 |
| August 11, 1888 | | 12,000.00 |
| September 19, 1890 | | 20,000.00 |
| July 13, 1892 | | 59,000.00 |
| August 18, 1894 | | 30,000.00 |
| June 3, 1896 | | 30,000.00 |
| March 3, 1899 | | 50,000.00 |
| June 6, 1900 | | 253,950.00 |
| March 3, 1901 | | 38,000.00 |
| June 13, 1902 (allotment) | | 23,250.00 |
| Miscellaneous receipts | | 1,027.15 |
| Total | | 859,340.15 |
| Amount carried to surplus fund, 1856 | | .80 |
| Balance | | 859,339.35 |

St. Joseph River, Michigan.

| | |
|---|---|
| [illegible] | $2,500 |
| [illegible] | 1,000 |
| [illegible] | 1,000 |
| [illegible] | 500 |
| [illegible] | 500 |
| [illegible] | 750 |
| Total | [illegible] |

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### ABSTRACT OF CONTRACTS IN FORCE.

*Pier extension.*

*Contractor:* The Lydon & Drews Company.
*Date of contract:* January [illegible], 1903.
*Date of approval:* February [illegible], 1903.
*Date of beginning:* May [illegible], 1903.
*Date of expiration:* June 30, 1903; changed to December 31, 1903, by supplemental contract dated September [illegible], 1903; time limit waived. Supplemental contract dated January [illegible], 1903, provides for use of Douglas fir or long-leaf yellow-pine timber in five lower courses of superstructure and for long-leaf yellow pine in the uppermost course of side and end walls of superstructure and in decking.

*Rates:* Dredging, 25 cents per cubic yard; foundation piles, 25 cents per linear foot; white-oak guard piles, 25 cents per linear foot; white-oak timber, $[illegible] per M feet B. M.; white-pine timber, $[illegible] per M feet B. M.; hemlock timber, $[illegible] per M feet B. M.; white-pine plank, $27.60 per M feet B. M.; driftbolts, screw bolts, and spikes, 4 cents per pound; stone, $[illegible] per cord.

*Repair of piers.*

*Contractor:* Chicago and Great Lakes Dredge and Dock Company.
*Date of contract:* May 16, 1903.
*Date of approval:* June 4, 1903.
*Date of beginning:* June 1, 1904, or earlier, at option of contractor.
*Date of expiration:* November 1, 1904, or within five working months if begun prior to June 1, 1904.

*Rates:* Cutting down and removing old work, $1.50 per linear foot; white-pine, long-leaf yellow-pine, or Douglas fir timber, $34 per M feet B. M.; white-pine or long-leaf yellow-pine plank for decking, $35 per M feet B. M.; driftbolts, screw bolts, and spikes, 4 cents per pound; stone, $1.50 per cord.

*Dredging.*

*Contractor:* The Lydon & Drews Company.
*Date of contract:* March 26, 1903.
*Date of approval:* May 6, 1903.
*Date of beginning:* May 24, 1903.
*Date of expiration:* October 8, 1903.
*Rate:* 16¼ cents per cubic yard.

*Contractor:* Samuel O. Dixon.
*Date of contract:* March 25, 1904.
*Date of approval:* April 15, 1904.
*Date of beginning:* May 3, 1904.
*Date of expiration:* September 17, 1904.
*Rate:* 17¼ cents per cubic yard.

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### COMMERCIAL STATISTICS FOR ST. JOSEPH HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statements furnished by the deputy collectors of customs at St. Joseph and Benton Harbor, Mich.]

*Character of vessels.*

| | Number. | Tonnage. |
|---|---|---|
| Steam | 1,385 | 790,243 |
| Sail | 45 | 5,106 |
| Total | 1,430 | 795,349 |

**Maximum draft, 16 feet.**

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Bottles, empty | 15 | Fruit | 28,651 |
| Bran | 150 | Lamp chimneys | 50 |
| Cedar posts | 10,230 | Lumber | 1,172 |
| Coal | 110 | Paper | 50 |
| Flour | 355 | Peanuts | 15 |
| Lath | 81 | Soap | 20 |
| Lumber | 5,652 | Vinegar | 75 |
| Salt | 1,588 | Merchandise, miscellaneous | 39,864 |
| Shingles | 1,475 | | |
| Stone | 17,681 | | |
| Sugar | 585 | | |
| Vinegar | 25 | | |
| Merchandise, miscellaneous | 20,028 | | |
| Total | 57,975 | Total | 69,897 |

| | Tons. |
|---|---|
| Total freight carried in 1902 | 188,545 |
| Total freight carried in 1903 | 127,872 |
| Decrease | 60,673 |

COMMERCIAL STATISTICS FOR ST. JOSEPH RIVER, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by Mr. E. A. Graham, St. Joseph, Mich.]

The steamers *May Graham*, *Tourist*, and *Willow* carried 33,500 passengers and 3,254 tons of freight (principally fruit, etc.), as compared with 31,000 passengers and 2,731 tons freight carried in 1902. The boats have a maximum draft of about 3 feet.

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## M M 3.

## IMPROVEMENT OF SOUTH HAVEN HARBOR, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1903, pages 1942–1943.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

The dimensions of the channel in the inner reach of the harbor created by the dredging of May and June, 1903, were found inadequate for the need of large and deep-draft steamers recently added to the fleet belonging to this harbor, and the return of the dredge of the Lydon & Drews Company, contractors, was requisite to further widen and deepen it. This was done between August 1 and 24, with the result of producing a channel 120 feet wide and 18 feet deep below the level of zero of gauge across the bar and 60 feet wide inside, with a depth of 16 feet between the piers and 15 feet in the river. The quantity dredged at this time was 21,757 cubic yards, at 16.5 cents.

The facilities thus provided remained serviceable for the remainder of the season, but soundings made April 1–9 showed an available depth at the zero stage of only 12.4 to 12.7 feet on the crossing of the outer bar, 15.6 feet between the piers, and 14 feet in the river in a narrow channel, with a shoal of 11.7 feet in the middle of the channel opposite the winding basin, the stage of the lake at the time being −0.8 to −1.3

feet. Dredging was begun May 4 under the contract with Samuel O. Dixon for the restoration of the needed width and depth of channel, and the small balance remaining available having been augmented on May 16 by the allotment of $5,000 from the emergency appropriation of June 13, 1902, it was possible to restore a channel 120 feet wide and 18 feet deep below zero of gauge through the bar and 60 feet wide and 15 feet deep between the piers and in the river as far as the Dunkley-Williams landing. The work was completed June 16, the dredged quantity being 34,255 cubic yards. The price per yard was 17½ cents.

On August 17 the steamer *Eastland*, belonging to the Michigan Steamship Company, broke the front wale and 3 piles in the south pier between stations 1+50 and 1+62. The damage was subsequently repaired by the steamship company at its expense.

The cost of the repairs of the outer end of the north pier, damaged by the steamer *City of Kalamazoo* on June 7, 1902, was finally collected from the Dunkley-Williams Company through the United States district attorney and deposited to the credit of the harbor on December 28, 1903.

The foregoing operations cost as follows:

| | |
|---|---|
| Dredging under contract with the Lydon & Drews Company | $3,589.91 |
| Dredging under contract with Samuel O. Dixon | 5,994.62 |

## CONDITION OF WORK JUNE 30, 1904.

This is as reported in the Report of the Chief of Engineers for 1901, page 3085, except for the additional deterioration due to the lapse of three years.

The channel between the piers has never been dredged to its full capacity, and this should be done. The channel in the river is narrow and needs widening. The enlargement of the channel to its full capacity is made especially desirable because of the increasing importance of this harbor.

## WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The approved project for this harbor, so far as new construction is concerned, is completed. The available balance of $976.66 will be reserved for incidental repairs.

## ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

As stated, new construction under the existing project is completed. Dredging will, however, continue to be increasingly necessary, at large annual expense, until the piers are carried at least as far as the 16-foot contour of Lake Michigan, and 667 linear feet of pier is in need of additional filling. The following estimate for maintenance is submitted:

| | |
|---|---|
| Dredging, refilling piers, and incidental repairs | $20,000.00 |

| | |
|---|---|
| Total amount appropriated and allotted to June 30, 1904 | $317,300.00 |
| Miscellaneous receipts | 2,137.47 |
| | 319,437.47 |

| | | |
|---|---|---|
| Total amount expended from March, 1867, to June 30, 1904: | | |
| For construction | $187,232.83 | |
| For maintenance | 128,534.99 | |
| | | $315,767.82 |
| Balance | | 3,669.65 |
| Estimated cost of the work, 1866, amended in 1869, 1872, 1892, and 1898. | | 297,000.00 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $4,780.97 |
| Deposit, December 28, 1903 | 2,056.27 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | 5,000.00 |
| | 11,837.24 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 8,167.59 |
| July 1, 1904, balance unexpended | 3,669.65 |
| July 1, 1904, outstanding liabilities | 78.79 |
| July 1, 1904, balance available | 3,590.86 |
| July 1, 1904, amount covered by uncompleted contracts | 2,614.20 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 20,000.00 |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 2, 1867 | $43,000.00 | August 5, 1886 | $5,000.00 |
| July 11, 1870 | 10,000.00 | August 11, 1888 | 10,000.00 |
| March 3, 1871 | 15,000.00 | September 19, 1890 | 15,000.00 |
| June 10, 1872 | 12,000.00 | July 13, 1892 | 10,000.00 |
| March 3, 1873 | 20,000.00 | August 18, 1894 | 20,000.00 |
| June 23, 1874 | 10,000.00 | June 3, 1896 | 15,000.00 |
| March 3, 1875 | 10,000.00 | March 3, 1899 | 45,000.00 |
| August 14, 1876 | 10,000.00 | June 6, 1900 (allotments) | 3,300.00 |
| June 18, 1878 | 12,000.00 | June 13, 1902 | 12,000.00 |
| March 3, 1879 | 7,500.00 | June 13, 1902 (allotment) | 5,000.00 |
| June 14, 1880 | 5,000.00 | Miscellaneous receipts | 2,137.47 |
| March 3, 1881 | 5,000.00 | | |
| August 2, 1882 | 10,000.00 | Total | 319,437.47 |
| July 5, 1884 | 7,500.00 | | |

### ABSTRACT OF CONTRACTS IN FORCE.

#### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16¼ cents per cubic yard.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17¼ cents per cubic yard.

COMMERCIAL STATISTICS FOR SOUTH HAVEN HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the deputy collector of customs at South Haven, Mich.]

| Character of vessels. | Number. | Tonnage. |
|---|---|---|
| Steam | 924 | 619,934 |
| Sail | 27 | 1,625 |
| Total | 951 | 621,559 |

**Maximum draft, 13.6 feet.**

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Lumber, posts, etc | 6,728 | Bark | 90 |
| Unclassed freight | 19,237 | Fruit | 36,282 |
| | | Unclassed freight | 14,309 |
| Total | 25,965 | Total | 50,681 |

| | Tons. |
|---|---|
| Total freight carried in 1902 | 103,620 |
| Total freight carried in 1903 | 76,646 |
| Decrease | 26,974 |

NOTE.—In Annual Report, 1903, item of lumber should be 6,825 tons and total freight carried 103,620 tons.

## M M 4.

## IMPROVEMENT OF HARBOR AT SAUGATUCK AND KALAMAZOO RIVER, MICHIGAN.

The history of these works is brought to the beginning of the fiscal year in the Report of the Chief of Engineers for 1903, pages 1945–1947.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

The dredging in progress at the beginning of the fiscal year under the contract with the Lydon & Drews Company was completed on July 29, and resulted in providing a channel 90 feet wide and 12 feet deep at the stage of zero of gauge across the outer bar and 30 feet wide and 10 feet deep through the shoal reaches inside. The quantity of sand removed in July was 24,939 cubic yards, making a total of 34,441 cubic yards since the beginning of operations in June, 1903. The price per yard was 16½ cents.

The available depths, referred to zero of gauge, found by soundings made April 20–22, 1904, were as follows: On the bar in front of the entrance, 6.4 feet on the southern approach to the entrance, 4.2 feet on line of south pier, and 3.2 feet farther north; in the channel between the piers, 10.9 feet on a line 40 feet from and parallel to the south pier, 7.5 feet on the first shoal above the bend, and 9 feet on the second shoal. The stage of the lake at the time of soundings was −0.6 to −1 foot. The magnitude of the shoaling on the bar during the winter and early spring greatly exceeded that of previous years, while the channel between and above the piers had maintained itself better.

Dredging for the restoration of the needed depth of navigation was begun on May 28 under the contract with Samuel O. Dixon. The limited amount of the available funds made it impossible to reopen the channel through the outer bar on the customary line in prolongation of the channel between the piers, and a narrow channel on a course following the relatively deeper water of the southern approach to the entrance was therefore planned. About 360 linear feet of one cut 13 feet deep on this course had been completed when, on June 1, the available funds were increased by an allotment of $5,300 from the emergency appropriation of June 13, 1902. In consequence of this it became possible to provide for a wider and deeper channel through the bar than at first was proposed, and the work since then has progressed with the view of producing a passage 90 feet wide with a resulting depth of 12 feet across the bar, and 30 feet wide with a resulting depth of 10 feet through the interior shoals, the depths referring to the stage of zero of gauge. At the end of the fiscal year one cut 30 feet wide, 13 to 14 feet deep, and 1,150 feet long had been completed through the bar and two other cuts of the same width and depth had been begun. The cut through the first shoal above the bend, 650 feet long, 30 feet wide, and 12 feet deep, had been completed. The dredged material measured 23,216.7 cubic yards. The price per cubic yard was 17½ cents.

Under date of July 15, 1903, a contract was entered into with Burk, Smith & Nelson for the construction of the two piers forming the protection to the entrance of the proposed new channel from Kalamazoo River to Lake Michigan, the work to begin April 15, 1904, and to be completed December 31, 1904. Operations under this contract were commenced in April. The two cribs, each 100 by 24 by 16½ feet, one of which is to be placed at the end of each pier, were built at Muskegon, to be towed to Saugatuck, when the arrangements for their being placed in position are completed. Three hundred and sixty-four piles, station 1+19 to station 12+08, were driven in the front row of the north pier, and 75 piles, station 6+77 to station 8+99, in the front row of the south pier, and the site of the crib for the north pierhead was partially dredged to the required depth. The site of the new entrance channel was surveyed in August and September and the lines were definitely located in January. The land required for the construction of the channel was deeded to the United States free of charge on February 15 by the owners of the ground, Marguerite Cook and David C. Cook.

The foregoing operations cost as follows:

| | |
|---|---|
| Dredging, under contract with the Lydon & Drews Company ........... | $4,114.94 |
| Dredging, under contract with Samuel O. Dixon ........................ | 4,062.92 |

Pier construction, under contract with Burk, Smith & Nelson—the work done has not yet been accepted by the United States.

## CONDITION OF WORK JUNE 30, 1904.

This remains as described in the Report of the Chief of Engineers for 1900, page 3888, with the added deterioration due to the lapse of four years.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

With the funds now available for the maintenance of the old entrance it is proposed to complete the dredging now in progress under the contract with Samuel O. Dixon for the temporary restoration of the needed depth of navigation.

The sundry civil act of March 3, 1903, appropriated $100,000 for the Kalamazoo River project, making the total amount available for that work $114,907.11. On July 15, 1903, contract was entered into with Burk, Smith & Nelson for the construction of the two parallel piers from the shore line to the outer end of the improvement, and work under this contract is now in progress. The work is to be completed December 31, 1904. Of the remaining balance, $24,000 has been allotted as part payment of the new hydraulic dredge and the rest will be reserved for contingencies.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

As the proposed new entrance to be created under the Kalamazoo River project can not possibly become available before the end of the calendar year 1906, it will be necessary to maintain the existing entrance in serviceable condition until that time, or for two seasons. Past experience proves that not less than $7,500 is required each year for the temporary restoration of an approximately satisfactory channel, and the estimate, therefore, is $15,000 for this purpose.

The original estimate for the Kalamazoo River project was $250,000. Of this, $115,000 has been made available by past appropriations, leaving $135,000 still to be appropriated. As stated above, the funds now available are to be applied to the construction of the projecting piers, and the new entrance can not become available for the use of navigation before the completion of the entire project. The estimate presented herewith, therefore, calls for the entire amount remaining to be appropriated, viz, $135,000.

The total estimate is, therefore, as follows:

| | |
|---|---|
| For maintenance of old entrance | $15,000 |
| For completion of Kalamazoo River project | 135,000 |
| Total | 150,000 |

### SAUGATUCK HARBOR.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $202,239.00 |
| Total amount expended from July, 1868, to June 30, 1904: | | |
| For construction | $90,231.99 | |
| For maintenance | 103,022.13 | |
| | | 193,254.12 |
| Balance | | 8,984.88 |
| Estimated cost of existing project, 1867, modified 1869, 1870, 1875, 1882, and 1892 | | 175,699.46 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $10,193.07 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | 5,300.00 |
| | 15,493.07 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 6,508.19 |
| July 1, 1904, balance unexpended | 8,984.88 |
| July 1, 1904, outstanding liabilities | 110.45 |
| July 1, 1904, balance available | 8,874.43 |
| July 1, 1904, amount covered by uncompleted contracts | 8,108.80 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 15,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

## KALAMAZOO RIVER.

| | |
|---|---|
| Total amount appropriated and allotted to June 30, 1904 | $115,000.00 |
| Total amount expended to June 30, 1904, for construction | 1,751.95 |
| Balance | 113,248.05 |
| Estimated cost of existing project, approved June 3, 1896, as amended May 31, 1900 | 250,000.00 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $114,848.08 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 1,600.03 |
| July 1, 1904, balance unexpended | 113,248.05 |
| July 1, 1904, outstanding liabilities | 164.06 |
| July 1, 1904, balance available | 113,083.99 |
| July 1, amount covered by uncompleted contracts | 82,602.61 |
| Amount (estimated) required for completion of existing project | 135,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 135,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

---

## APPROPRIATIONS FOR IMPROVING SAUGATUCK HARBOR AND KALAMAZOO RIVER, MICHIGAN.

| Date. | Saugatuck Harbor. | Kalamazoo River. | Total. |
|---|---|---|---|
| July 25, 1868 (allotment) | $23,900 | | $23,900 |
| April 10, 1869 (allotment) | 6,039 | | 6,039 |
| July 11, 1870 | 10,000 | | 10,000 |
| March 3, 1871 | 10,000 | | 10,000 |
| June 10, 1872 | 15,000 | | 15,000 |
| March 3, 1873 | 10,000 | | 10,000 |
| June 23, 1874 | 10,000 | | 10,000 |
| March 3, 1875 | 10,000 | | 10,000 |
| August 14, 1876 | 3,000 | | 3,000 |

### APPROPRIATIONS FOR IMPROVING SAUGATUCK HARBOR AND KALAMAZOO RIVER, MICHIGAN—continued.

| Date. | Saugatuck Harbor. | Kalamazoo River. | Total. |
|---|---|---|---|
| June 18, 1878 | $2,500 | | $2,500 |
| March 3, 1879 | 5,000 | | 5,000 |
| June 14, 1880 | 5,000 | | 5,000 |
| March 3, 1881 | 5,000 | | 5,000 |
| August 2, 1882 | 8,000 | | 8,000 |
| July 5, 1884 | 4,000 | | 4,000 |
| August 5, 1886 | 8,000 | | 8,000 |
| August 11, 1888 | 5,000 | | 5,000 |
| July 13, 1892 | 5,000 | | 5,000 |
| August 18, 1894 | 12,000 | | 12,000 |
| June 3, 1896 | 10,000 | $5,000 | 15,000 |
| March 3, 1899 | 7,000 | 10,000 | 17,000 |
| June 6, 1900 (allotment) | 7,500 | | 7,500 |
| June 13, 1902 | 15,000 | | 15,000 |
| June 13, 1902 (allotment) | 5,300 | | 5,300 |
| March 3, 1903 | | 100,000 | 100,000 |
| Total | 202,239 | 115,000 | 317,239 |

### ABSTRACT OF CONTRACTS IN FORCE.

#### *Pier construction.*

Contractor: Burk, Smith & Nelson.
Date of contract: July 15, 1903.
Date of approval: August 31, 1903.
Date of beginning: Not later than April 15, 1904.
Date of expiration: December 31, 1904.
Rates: Dredging for crib foundations, 75 cents per cubic yard; foundation piles, 50 cents per linear foot; white-oak piles, 32 cents per linear foot; white-oak timber, $50 per M; white pine, long-leaf yellow pine, or Douglas fir timber, $33 per M; hemlock or Norway pine timber, $24 per M; white pine, long-leaf yellow pine, or Douglas fir planks for sheet piles, $40 per M; white pine or long-leaf yellow pine planks for decking, $32 per M; driftbolts, screw bolts, tie-rods, carriage bolts, and spikes, 3 cents per pound; stone, $6.90 per cord.

#### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

### COMMERCIAL STATISTICS FOR SAUGATUCK HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by Messrs. Griffin & Henry, of Saugatuck, Mich.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| | 886 | 90,912 |
| | 26 | 1,024 |
| | 912 | 91,936 |

*Receipts and shipments by vessels, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Cedar posts | 30 | Apples | 1,500 |
| Coal | 3,250 | Fruit, miscellaneous | 3,255 |
| Lath | 105 | Fish | 45 |
| Lime | 59 | Household goods | 63 |
| Live stock | 4 | Live stock | 6 |
| Lumber | 1,750 | Potatoes | 58 |
| Shingles | 125 | Poultry | 6 |
| Wood | 1,800 | | |
| Merchandise, miscellaneous | 535 | | |
| Total | 7,658 | Total | 4,933 |

| | Tons |
|---|---|
| Total freight carried in 1903 | 12,591 |
| Total freight carried in 1902 | 11,843 |
| Increase | 748 |

## M M 5.

## IMPROVEMENT OF HARBOR AT HOLLAND (BLACK LAKE), MICHIGAN.

The history of this work is brought to the close of the last fiscal year in the Report of the Chief of Engineers for 1903, pages 1948–1950.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

Operations under the contract with Robert Love & Co. for (1) repairing the north pier between stations 0 and 2+55; (2) repairing the north pier between stations 12+64 and 17+98; (3) repairing the south pier between stations 0+05 W. and 2+02, and (4) repairing the south pier between stations 11+74 and 16+86 were begun on July 7. The work on sections 1 and 3 was completed in November, and consisted in cutting down the timber work to the level of zero of gauge, building a new superstructure 6 feet high, filling the space between the projecting horns above water at the outer end with a solid timber structure, replacing the old stone filling and putting on a new deck. Operations on sections 2 and 4 were suspended during the winter, and were finally completed in April. The work done on section 2, north pier, station 12+64 to station 17+98, was as follows: The old structure was cut down to grade; the substructure of the rear wall between stations 12+64.5 and 13+09.5, and at stations 14+17.5, 14+35.5, and 16+88.5 was strengthened with piles and screw bolts and otherwise repaired where required, the old piles in the front wall between stations 16+23 and 17+98 and in the rear wall between stations 14+85.6 and 17+98 were capped with a 12 by 12 inch timber, the guide timber was secured and 522 compound sheet piles were driven and secured by upper and lower binders from station 12+65 to station 17+98. The work was protected in front by 89 round piles and an oak wale, and the front and rear walls were tied together by 67 tie-rods. The pier was provided with a new superstructure 4 feet high in the front wall and 2 feet high in the rear wall, and a plank walk was put in place on top. Between stations 14+19 and 14+34 an opening was provided in the superstructure for the convenience of the Life-Saving Service. In section 4, south pier, station 11+74 to station 16+85.9, the work consisted in driving a wall of compound sheet piles and round piles on the channel side of the structure and at the east end, secured by guide and binding timbers, front and rear wales, and tie-rods. The number of compound sheet piles driven in this section was 521, and that of the round piles 92. The top of the sheet piles is at the level of zero of gauge; and the space between it and the bottom of the old superstructure, which remains in place, was closed with 6 by 12 inch timbers screw bolted to the faces of the old piles. The width of the opening through the superstructure at the [illegible] was increased on the channel side by cutting away the front wall from station [illegible] to station [illegible], and a new bulkhead was built [illegible] across the [illegible].

[illegible]

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The dredging now in progress under the contract with Samuel O. Dixon will be completed at an estimated total cost of about $7,000. Twenty thousand dollars has been allotted as part payment of the hydraulic dredge, and $1,000 is reserved as part payment of an inspection steamer. The remainder of the available funds will be reserved for additional dredging, incidental repairs, and contingencies.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

The piers at this harbor have not been extended since 1880, and in the meantime the shore line on both sides have advanced, and the lake bottom in the neighborhood of the entrance has shoaled so that the natural depth is but 7 to 8 feet. The present approved project calls for a 16-foot channel, which is urgently needed by the navigation interests. To provide this channel the approved project provides for extending the north pier 800 feet and the south pier 700 feet. The estimate makes provision for one-half of this pier extension, or 400 feet for each pier, which can be advantageously built in one season. The piers now being in serviceable condition, it is practicable to dredge the channel to its projected capacity. This will require the removal of about 65,000 cubic yards of material, at an estimated cost of $11,000. The estimate for maintenance is $5,000 for dredging during another season and $5,000 for incidental repairs.

The total estimate is therefore as follows:

| | | | |
|---|---|---|---|
| For new construction and dredging: | | | |
| 800 feet cribwork, at $90 | | $54,000.00 | |
| 200 feet cribwork, at $120 | | 24,000.00 | |
| Dredging channel to full capacity | | 11,000.00 | |
| | | | $89,000.00 |
| Add 10 per cent for contingencies | | | 8,900.00 |
| | | | 97,900.00 |
| For maintenance: | | | |
| Dredging | | $5,000.00 | |
| Incidental repairs | | 5,000.00 | |
| | | | 10,000.00 |
| Total | | | 107,900.00 |
| Total amount appropriated and allotted to June 30, 1904 | | | 419,315.31 |
| Miscellaneous receipts | | | 1,100.00 |
| | | | 420,415.31 |
| Less amount carried to surplus fund | | | 1.19 |
| | | | 420,414.12 |
| Total amount expended from August, 1852, to March 3, 1899: | | | |
| For construction | $176,619.80 | | |
| For maintenance | 127,597.50 | | |
| | | $304,217.30 | |
| Total amount expended to June 30, 1904, on project approved March 3, 1899: | | | |
| For construction | 34,457.10 | | |
| For maintenance | 43,613.49 | | |
| | | 78,070.59 | |
| | | | 382,287.89 |
| Balance | | | 38,126.23 |
| Estimated cost of existing project approved March 3, 1899 | | | 240,000.00 |

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $67,414.99 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 29,288.76 |
| July 1, 1904, balance unexpended | | 38,126.23 |
| July 1, 1904, outstanding liabilities | | 12.07 |
| July 1, 1904, balance available | | 38,114.16 |
| July 1, 1904, amount covered by uncompleted contracts | | 6,900.65 |
| Amount (estimated) required for completion of existing project | | 129,500.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $97,900.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 107,900.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | |
|---|---|
| Black Lake: | |
| August 30, 1852 | $8,000.00 |
| June 23, 1866 | 55,615.31 |
| March 2, 1867 | 51,000.00 |
| July 11, 1870 | 10,000.00 |
| March 3, 1871 | 10,000.00 |
| June 10, 1872 | 10,000.00 |
| March 3, 1873 | 12,000.00 |
| June 23, 1874 | 15,000.00 |
| March 3, 1875 | 15,000.00 |
| August 14, 1876 | 15,000.00 |
| June 18, 1878 | 10,000.00 |
| March 3, 1879 | 6,000.00 |
| June 14, 1880 | 6,000.00 |
| March 3, 1881 | 6,000.00 |
| August 2, 1882 | 10,000.00 |
| July 5, 1884 | 15,000.00 |
| August 5, 1886 | 5,000.00 |
| Black Lake—Continued. | |
| August 11, 1888 | $5,000.00 |
| September 19, 1890 | 10,000.00 |
| Holland: | |
| July 13, 1892 | 5,000.00 |
| August 18, 1894 | 15,000.00 |
| June 3, 1896 | 10,000.00 |
| March 3, 1899 | 37,500.00 |
| June 6, 1900 (allotments) | 4,200.00 |
| June 13, 1902 | 73,000.00 |
| Miscellaneous receipts | 1,100.00 |
| Total | 420,415.31 |
| Amount carried to surplus fund | 1.19 |
| | 420,414.12 |

### ABSTRACT OF CONTRACTS IN FORCE.

#### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

#### *Repair of piers.*

Contractor: Robert Love & Co.
Date of contract: May 18, 1903.
Date of approval: June 1, 1903.
Date of beginning: July 1, 1903.
Date of expiration: May 1, 1904.

Rates: Cutting down and removing old work, $3 per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $45 per M feet B. M.; white-pine, long-leaf yellow-pine, or Douglas fir timber, $33 per M feet B. M.; white-pine, long-leaf yellow-pine, or Douglas fir plank for sheet piles, $42 per M feet B. M.; white-pine or long-leaf yellow-pine planks for decking, $30 per M feet B. M.; driftbolts, screw bolts, carriage bolts, tie-rods, and spikes, 3½ cents per pound.

*Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

### COMMERCIAL STATISTICS HOLLAND (BLACK LAKE) HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by Graham & Morton Line, of Holland, Mich.]

| | |
|---|---|
| Steam vessels: | |
| Number | 678 |
| Tonnage | 769,586 |
| Maximum draft, feet | 14 |

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Felt roofing | 49 | Fruit | 2,227 |
| Flour | 55 | Furniture | 706 |
| Hides | 98 | Hides | 44 |
| Leather | 17 | Leather | 601 |
| Live stock | 32 | Live stock | 9 |
| Lumber | 130 | Merchandise, miscellaneous | 4,068 |
| Merchandise, miscellaneous | 6,156 | Potatoes | 142 |
| Soap | 33 | Sugar | 590 |
| Sugar | 53 | Vinegar | 1,420 |
| Total | 6,623 | Total | 9,807 |

## M M 6.

## IMPROVEMENT OF GRAND HAVEN HARBOR, MICHIGAN.

The history of this work is brought to the close of the last fiscal year in the Report of the Chief of Engineers for 1903, pages 1952–1954.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

The repairs of the north pier between stations O and 6+09 E., which were commenced in March, 1903, under the contract with Robert Millen & Co., were completed on July 25. The work consisted in removing the old timber work above the level of zero of gauge, repairing the substructure where required, building a new superstructure 6 feet high; replacing the old stone filling and putting on a new deck.

As stated in the last annual report, the filling in the south revetment had settled considerably, and the river bottom along the face of this work had been eroded to such a depth that the structure was in need of heavy riprapping for its support and safety. The necessity of protecting this structure in the indicated manner caused an informal contract to be entered into with Leathem & Smith Towing and Wrecking Company for furnishing 750 cords stone, the major part of which to be applied for riprapping the channel face of the south revetment between stations 35 and 45, and a small quantity to be used for refilling the pier in a few places where breaks in the front wall had been repaired. The work was to be begun September 15 and to be completed October 15, but only two loads with a total of about 480 cords were received before the close of the season, of which 413 cords were used to riprap the revetment between stations 45 and 38+75, and the remainder for refilling the pier. The contract will be completed in 1904.

A break in the filling of the north pier between stations 7+63 and 8+11, at shore line, caused by the storm of November 12, which permitted large quantities of sand to be swept through the pier into the channel, was closed with timber aprons behind the piles of the front wall and with brush and stone filling, the brush being cut by day labor, and the 22½ cords stone used being borrowed from the filling of the north pier between stations 15+50 and 20+50.

The flood in Grand River at the end of March caused great damage to both piers, and serious shoaling of the channel at the entrance and immediately outside. Complaints by the vessel interests on account of the shoaling were received early in April and an examination made April 6–8 showed an available depth of 16.8 feet, referred to zero of gauge, in the channel at the outer end of the piers, and the 20-foot curve in the lake at distances of 1,100 to 1,700 feet outside of the piers, with 16.5 feet on the line of the south pier, 12.4 feet on the shoalest point of the bar, and 14 feet on the line of the north pier. Stage of the lake at time of soundings was −0.8 to −1 foot. The necessity of relief at the earliest practicable moment being apparent, and the small amount of the available funds being insufficient for this purpose, an allotment of $10,000 from the emergency appropriation of June 13, 1902, was obtained upon the recommendation of this office, and a contract was entered into with the Chicago and Great Lakes Dredge and Dock Company for deepening and widening the channel across the bar and inside. In the meanwhile an examination was made April 30 to May 2, at which time the available depth between the end of the piers was found to be 17.6 feet, that outside on the line of the south pier 15.9 feet, on the shoalest point of the bar in front of the entrance 12.8 feet, and on the line of the north pier 14.5 feet, the depths being referred to zero of gauge. On May 31 an additional allotment of $20,000 was made available from the emergency appropriation of April 28, 1904, for work at Grand Haven, and the total amount of dredging to be done was increased to 100,000 cubic yards. The contractors began operations on May 13, and at the end of the fiscal year the southern approach to the entrance had been dredged for a width of 225 feet, the seven cuts varying in length from 655 to 1,540 feet, and in addition two cuts, 1,735 feet and 790 feet long, respectively, had been made inside. The depth of the cuts was 20 feet below zero of gauge, and the resulting depth of the channel over the areas dredged is 18 feet. The dredged material measured 76,577 cubic yards, and the price per cubic yard was 16.9 cents.

Numerous repairs to breaks in the existing works were made by purchased material and hired labor, as follows:

1. South pier, station 45+34.5 to station 46+63, damaged by the steamer *Hackley* of the Barry Line on October 19, 1902. The owners

of the steamer settled for the damage through the United States district attorney.

2. South pier, station 2+68.2 to station 2+74.4 E., damaged by the steamer *Frontenac*, temporarily running in connection with the Crosby Transportation Company, on October 13, 1902.

3. An old break in the front wall of the substructure of the south pier between stations 3+87.3 and 4+01.7 W.

4. South pier, near station 8+99, damaged by the car ferry *Grand Haven* of the Crosby Line on October 22, 1903.

5. North pier, station 21+20.5 to station 21+84.5, damaged by the steamer *Naomi* of the Crosby Line on December 1, 1903.

6. South pier, station 39+92.9 to station 40+40, damaged by the car ferry *Grand Haven* of the Crosby Line on February 7, 1904.

The repairs consisted in removing the broken timbers and replacing them by new ones. The cost of the repairs, except where made by the owners, has been or is to be collected from the owners of the steamers, as far as they are ascertained, through the United States district attorney.

A temporary dam of sand-filled sacks was built behind the north revetment at station 23, connecting the structure with the shore, during the flood in Grand River, to prevent further erosion of the bank and damage to the revetment.

The foregoing operations cost as follows:

| | |
|---|---|
| Repair of north pier, under contract with Robert Millen & Co. | $2,214.42 |
| Refilling and riprapping south revetment under informal contract with Leathem & Smith Towing and Wrecking Company | 3,025.52 |
| Minor repairs of piers, etc., by purchased material and hired labor | 2,397.17 |
| Dredging, under contract with Chicago and Great Lakes Dredge and Dock Company | 12,941.51 |

## CONDITION OF WORK, JUNE 30, 1904.

The piers and revetments are in good or fair condition, except as follows:

During the flood in Grand River at the end of March and beginning of April the filling in the south revetment between stations 30 and 46+63 was partly washed out or settled greatly, and the work between stations 32+50 and 36+50 was practically destroyed, the river bottom in front of the work being eroded to a depth of 40 feet and more. Many piles lost their hold in the ground altogether, the structure canted forward into the channel to an extent of 12 feet, and it would have been swept away but for the prompt intervention of the assistant in charge of work at the harbor, who held it in place by a series of rope and chain anchoring attachments. It was hoped at the time that the revetment could be pulled back approximately into its old position and then secured by a heavy riprap in front, but an attempt made in this direction proved a failure, and nothing remains to be done except to entirely remove the existing work between stations 32+50 and 36+50 and to rebuild it. The remainder of the revetment between stations 30 and 46+63 requires new filling, and the entire length between these stations, as far as this has not already been done, must be protected on the channel side by a heavy riprap. At the same time the current attacked with great force the inner end of the north revetment, 50 feet of which was washed away entirely, and 80 feet more was undermined and is practically ruined. Fifteen hundred and twenty-three linear feet of the north revetment, of which the above is a part, is 17 to 19 years old above water, and will soon require a new superstructure, while the filling in it and in the adjacent stretches of 604 feet has badly settled and requires partial renewal. The superstructure of 1,107 linear feet of the south pier, station 7+05 E. to station 4+02 W. is 20 to 22 years old, and the time has come to provide for rebuilding it. Two hundred and four feet more is 18 to 19 years old. The filling in the pile work from station 4 to station 30 is very low and needs renewal.

The following cases of damage to piers and revetments by colliding vessels have occurred during the fiscal year:

1. On October 8 the steamer *Alice Stafford* of the Barry Line broke the top course, front wall, of the south pier between stations 45+58.1 and 45+82.1.

2. On October 22 the car ferry *Grand Haven* of the Crosby Transportation Company ran into the south pier at station 8+99, breaking a cross-tie.

3. On December 1 the steamer *Naomi* of the Crosby Line ran into the north pier and broke the timbers in both side walls of the superstructure between station 21+20.5 and station 21+84.5.

4. On February 7 the car ferry *Grand Haven* broke or damaged the two top courses of the south pier between stations 39+92.9 and 40+40, and an iron tie-rod.

The repairs of the above breaks have been made either by the owners of the steamers or by the United States. The following cases of damage still remain unrepaired:

5. (*a*) On March 26 the car ferry *Grand Haven*, going out, ran into the south pier near station 42, breaking several timbers of the superstructure.

(*b*) At the same time she struck the north pier at several places where the damage consisted in displacing some timbers and in chopping away some deck planks by the crew.

(*c*) The steamer then backed into the south pier and broke five courses of the superstructure between stations 3+50 and 4 W., and also the decking.

6. On March 31, the car ferry *Grand Haven*, entering the harbor, ran into the south pier between stations 23+74 and 24+42, breaking the entire superstructure and pushing it off the piles.

7. On April 5 the car ferry *Grand Haven* struck the outer end of the north pier on the southwest corner, breaking the guard timbers and knocking off the horns of the front wall in the upper seven courses.

8. On April 8 the steamer *Atlanta*, of the Goodrich Line, entering, struck the south pier and destroyed the front wall for a depth of 14 courses between stations 6+89 and 7+23, besides breaking a number of cross-ties, the top course of the rear wall between stations 7+11 and 7+24, and half the deck between stations 6+92 and 7+27.5. A large part of the stone filling dropped into the channel.

9. On June 5 the steamer *Hackley*, of the Barry Line, going out in a dense fog, damaged the north pier between stations 6+25 and 6+60. The front wall between stations 6+36 and 6+56 was entirely torn out to below the water surface; many cross-ties and the decking were broken, and the stone filling dropped out.

The condition of the channel of navigation is as described under the head of operations.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The dredging under contract with the Chicago and Great Lakes Dredge and Dock Company will be continued until the total quantity removed amounts to 100,000 cubic yards. Leathem & Smith will complete their contract for furnishing stone for riprapping part of the south revetment. The breaks in the piers caused by colliding vessels will be repaired. Of the remaining balance $4,300 will be reserved for part payment of an inspection steamer and the remainder for repairing the south revetment and for contingencies. If possible, the south revetment between stations 32+50 and 36+50 will be rebuilt, and the work between stations 30 and 46+63 will be refilled and protected with stone riprap on the channel side, and as the available funds do not suffice for this purpose, a special allotment of $20,000 from the emergency appropriation of April 28, 1904, has been requested.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $809,366.15 |
| Miscellaneous receipts | | 5,576.92 |
| | | 814,943.07 |
| Total amount expended from August, 1852, to June 30, 1904: | | |
| For construction | $542,976.82 | |
| For maintenance | 238,923.95 | |
| | | 781,900.77 |
| Balance | | 33,042.30 |
| Estimated cost of work, 1866, amended in 1880, 1890, and 1892 | | 804,366.15 |

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $18,877.09 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of— | | |
| June 13, 1902 | $10,000.00 | |
| April 28, 1904 | 20,000.00 | |
| | | 30,000.00 |
| | | 48,877.09 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 15,834.79 |
| July 1, 1904, balance unexpended | | 33,042.30 |
| July 1, 1904, outstanding liabilities | | 270.45 |
| July 1, 1904, balance available | | 32,771.85 |
| July 1, 1904, amount covered by uncompleted contracts | | 12,470.09 |
| Amount (estimated) required for completion of existing project | | 34,375.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $34,375.00 | |
| For maintenance of improvement | 46,970.00 | |
| | | 81,345.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

The steel hull and a cabin for the new suction dredge *General Ludlow*, which were in course of construction at the yard of the contractor, Thomas Johnston, Ferrysburg, Mich., at the beginning of the fiscal year, were completed and accepted May 4, 1904. Two Scotch marine boilers and a steel mast and boom were also constructed by Contractor Johnston for this dredge. The boilers were accepted on April 9 and the mast and boom on April 29. The main pump, main engine, jet condenser and air pump, electric-light outfit and machine-shop tools were purchased under separate contracts from the makers. The jet pump and engines, hauling engines, valve-opening engines, machine-shop engine, fire and feed pumps were made over from old machinery on hand and installed, together with the new machinery, by hired labor and the use of the machine-shop tools purchased for the dredge. The *Ludlow* was completed and ready for work on May 20. The accompanying plant was fitted out and the fleet towed to County House bar, where it arrived May 31. During the month of June this dredge completed a channel of navigable width and a depth of 6 feet (below low water) through all bars having less than 4.5 feet of water on them, between the sixteenth and twenty-third miles, excavating 50,331 cubic yards of sand and clay, at a cost of 3.67 cents per cubic yard. The total amount dredged during this fiscal year by both dredges is 121,514 cubic yards.

The contraction works built during the year were in continuation of those of prior years. Eleven of the existing walls were extended downstream, and eight entirely new walls were constructed in continuation of the contraction scheme. The operations of the season embraced that portion of the river between the second and twenty-second miles below Grand Rapids and consisted in building 12,443 linear feet of new work. Frequent rains maintained a stage in the river that would not allow any repair work to be done and completely stopped construction work on August 28. The remaining material for this work was safely stored for the winter season, and the last of the plant was laid up at Grand Haven on October 24. Since this work was far in advance of the dredging operations and the high stage of the river previous to June 30 prevented the resumption of repair work, nothing further was done during the fiscal year.

The foregoing operations cost as follows:

| | |
|---|---|
| Dredging | $12,807.81 |
| Contraction work | 9,395.51 |
| Construction of suction dredge *General Ludlow* | 49,300.00 |

### CONDITION OF WORK JUNE 30, 1904.

This is illustrated on the accompanying maps, which show the location and extent of all dredge cuts and training walls which have been made since the beginning of operations under the present project, and the available channel depths reduced to the low-water stage, from Grand Rapids to the mouth of Bass River, 23 miles below. The available depth at extreme low water between Bass River and Grand Haven is 5 feet. During the spring flood the river reached the highest stage ever recorded, viz, 26.4 feet on the Grand Rapids gauge. This is 5.1 feet above the highest previous record. The current at Grand Haven reached a velocity of 6.6 miles per hour. The greatest previous velocity was 3½ miles per hour. The discharge at Grand Haven was found to be approximately 77,500 cubic feet per second. The greatest previous high-water discharge was slightly more than 26,000 cubic feet per second. The low-water discharge is approximately 1,000 cubic feet per second. In previous high-water stages there has been no evidence of sand movement. The river carried a small amount of silt brought from plowed fields, but very little, if any, sand. The deposit of sand on the banks after last spring's flood varied in depth from a few inches to 2 feet. The effect of the flood on the channel, on the whole, was rather beneficial than otherwise.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The dredging operations which are now in progress will be continued through the present season and as much longer as the available funds will permit. Only such repairs to contraction works will be made as are absolutely necessary to save the existing works and protect the spoil banks. No new works will be built.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

The annual expenditure of small appropriations on this project is of doubtful expediency. Such a course will prolong the work far beyond the time contemplated in the original estimate of cost; will, on account of the cost of maintenance, greatly increase the amount necessary to complete the work, and, moreover, render the possibility of an ultimate completion of the project problematical. It is therefore thought that nothing less than $200,000 should be provided for the continuance of this work.

| | | |
|---|---|---|
| Total amount appropriated to June 30, 1904 | | $325,000.00 |
| Total amount expended on previous project from March, 1881, to June, 1896 | | 50,000.00 |
| | | 275,000.00 |
| Total amount expended on present project, approved June, 3, 1896: | | |
| For construction | $224,384.88 | |
| For maintenance | 11,001.82 | |
| | | 235,386.70 |
| Balance | | 39,613.30 |
| Original estimated cost of project, approved June 3, 1896 | | 670,500.00 |
| Amended by act of June 13, 1902 | | 774,000.00 |

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $117,449.06 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | [a] 77,835.76 |
| July 1, 1904, balance unexpended | 39,613.30 |
| July 1, 1904, outstanding liabilities | 650.00 |
| July 1, 1904, balance available | 38,963.30 |
| Amount (estimated) required for completion of existing project | 499,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 200,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

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[a] $200 used by Board of Engineers for Rivers and Harbors.

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1881 | $10,000 | March 3, 1899 | $75,000 |
| August 2, 1882 | 15,000 | June 13, 1902 | 150,000 |
| July 5, 1884 | 25,000 | | |
| June 3, 1896 | 50,000 | Total | 325,000 |

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### ABSTRACT OF CONTRACTS IN FORCE.

*Construction of steel hull and cabin for suction dredge.*

Contractor: Thomas Johnston.
Date of contract: June 16, 1903.
Date of approval: July 31, 1903.
Date of beginning: August 13, 1903.
Date of expiration: December 3, 1903; time limit waived.
Rate: Lump sum of $21,000.

*Steam plant for suction areage.*

Contractor: Thomas Johnston.
Date of contract: August 22, 1903.
Date of approval: October 8, 1903.
Date of beginning: October 22, 1903.
Date of expiration: March 12, 1904.
Rate: Lump sum of $8,000.

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### COMMERCIAL STATISTICS FOR GRAND RIVER, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by Mr. G. W. Bunker, assistant engineer.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 3,450 | 54,718 |
| Other craft | 960 | 98,896 |
| Total | 4,410 | 153,614 |

*Freight carried on Grand River, 1903.*

| | Tons. | | Tons. |
|---|---|---|---|
| Berry crates and baskets | 2 | Piles and fascines | 1,500 |
| Bolts, stave, etc | 2,252 | Shingles | 286 |
| Brick | 686 | Wood | 10,132 |
| Gravel | 30,000 | | |
| Houses | 90 | Total | 83,332 |
| Iron ore | 35,000 | Total freight carried in 1902 | 55,614 |
| Lath | 450 | | |
| Logs | 2,210 | Increase | 27,718 |
| Lumber | 724 | | |

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### REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS RELATIVE TO THE COMPLETION OF THE PROJECT FOR THE IMPROVEMENT OF GRAND RIVER, MICHIGAN.

[Printed in House Doc. No. 216, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 2, 1903.*

Sir: I have the honor to submit herewith a report, dated November 11, 1903, by the Board of Engineers for Rivers and Harbors, relative to the improvement of Grand River, Michigan, made in pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, transmitted to this office by letter of Hon. T. E. Burton, dated April 25, 1903, an extract from which is quoted in the accompanying report.

The existing project for the improvement of this locality contemplates providing a channel through the bars 10 feet deep and 90 to 100 feet wide up to Fulton street, in the city of Grand Rapids. The amount estimated for completing this improvement, as presented in the Annual Report for 1903, is $499,000, but the Board states that the project can not be completed for that amount, and presents an estimate of the cost of work remaining to be done, amounting to $970,000. The Board believes, however, that a 6-foot channel would accomplish for the community in and about Grand Rapids practically as much as a 10-foot channel, and submits a project for a 6-foot channel 100 feet wide from Fulton street, in Grand Rapids, to Grand Haven, Mich., which is estimated to cost $430,000. In addition to $103,000, now available in plant and cash, for prosecuting the work under present project, $327,000 would be required to produce a 6-foot channel, supposing that the entire amount be made available for work with the plant already provided not later than one year hence.

The Board expresses the opinion, in which I concur, that it is advisable to modify the project for the improvement of Grand River, with a view to securing and maintaining a 6-foot channel, 100 feet wide, from Fulton street, in Grand Rapids, to Grand Haven, Mich., at a cost of $327,000, in addition to the plant and funds now available. The cost of maintaining such a channel is estimated at $20,000 per annum.

I recommend that this letter and the accompanying paper be transmitted to the Speaker of the House of Representatives, for the information of Congress, in response to above-mentioned resolution.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

Board of Engineers for Rivers and Harbors,
*Washington, D. C., November 11, 1903.*

General: By first indorsement, Office Chief of Engineers, United States Army, May 1, 1903, there was referred to the Board of Engineers for Rivers and Harbors a resolution adopted by the Committee on Rivers and Harbors of the House of Representatives, of which the following is an extract:

> *Resolved by the Committee on Rivers and Harbors,* That the Board of five engineer officers established by section three of the river and harbor act of June thirteenth, nineteen hundred and two, be requested to make reports to Congress not later than the first Monday in December, nineteen hundred and three, upon the following projects, with a view to making recommendations upon the desirability of continuing the same, or any modification thereof, or to report as specifically stated with the designation of the respective projects:
>
> Grand River, Michigan: Can the project be completed at the estimated cost?

* * * * * * *

2. The Board has believed that a categorical answer to the question propounded by the Committee on Rivers and Harbors is not all that is desired by the committee of Congress, but that the Board should express opinion as to the probable cost and nature of such an improvement of Grand River as seems advisable, having in mind the relation borne by the waterway to the commerce of the United States.

3. The Board has studied existing data upon this subject, including reports and estimates recently prepared by the district officer and the assistant engineer in immediate charge of the work. A committee of the Board held a public hearing at Grand Rapids on October 15, 1903, and inspected the river from Grand Rapids to the mouth.

4. From Grand Rapids to Grand Haven, the latter a harbor upon the east shore of Lake Michigan, is a distance measured along Grand River of 38 miles. At low water, before any dredging was done, 2 feet was the controlling depth across the bars. Between 1881 and 1886, $50,000 was expended in dredging narrow channels across the bars to a depth of 4 feet. The present project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon the report of a survey submitted in 1892. The existing project contemplates securing a channel through the bars 10 feet deep and from 90 to 100 feet wide. The estimate for this project was $670,500.

5. Appropriations for the execution of the existing project have been as follows:

| | |
|---|---|
| 1896 | $50,000 |
| 1899 | 75,000 |
| 1902 | 150,000 |
| Total | 275,000 |

Of this amount there was expended to October 1, 1903:

| | |
|---|---|
| For dredging | $76,058.41 |
| For training walls | 74,512.66 |
| For plant now available for prosecuting work | 21,220.33 |
| Total | 171,791.40 |

Of the balance of $103,208.60 about $70,000 is reserved for plant now being constructed, and the remainder is available for operating the same.

6. The total material dredged in execution of the existing project to October 1, 1903, was 470,829 cubic yards out of a total of 4,070,000 as originally estimated. The dredging has been so delayed that a part of the work done has resulted in no net gain. The appropriations have not been such as to permit a continuing contract to be made, nor has any appropriation until the last been sufficient for the procurement of suitable plant, with the assurance that a reasonable balance would remain for its operation.

7. The last river and harbor act extended the projected channel from its upper terminus, as originally planned, to Fulton street, in Grand Rapids, a distance of approximately 3,200 feet. Furthermore, due to the lowering of the mean level of Lake Michigan in recent years, in order to secure 10 feet to Grand Rapids, it will be necessary to excavate to a plane seven-tenths foot lower than was contemplated in the existing project.

8. Due to the changes recited in the preceding paragraph, the quan-

tities to be excavated must be increased, and the extension of the channel up to Fulton street will make necessary a dam just above that point which was not provided for in the original project.

9. Experience in the work thus far enables a classification of the materials to be made, and thus permits a closer estimate of cost than was possible in 1892. The amount of work remaining to be done, as furnished from the records at Grand Rapids, and estimated at unit prices fixed by the Board, is as follows:

| | |
|---|---|
| Dredging 370,000 cubic yards, at the extreme upper end of the improvement, where there will be difficulty in disposing of material, at 35 cents | $129,500 |
| 940,000 cubic yards hard material, at 20 cents | 188,000 |
| 3,760,000 cubic yards sand, at 10 cents | 376,000 |
| Dam at upper end of winding basin | 20,175 |
| Wing dams and training walls | 100,000 |
| Administration and contingencies | 156,325 |
| Total | 970,000 |

10. Referring to paragraph 5 above, it will be noted that there is on hand or under construction a plant valued at about $90,000, together with an available cash balance of about $33,000. If the work is to be completed there will be required additional appropriations aggregating $847,000. These estimates are based on the supposition that funds will be provided so that the work may be done at a rapid and economical rate.

11. In view of what precedes, the Board believes that the project can not be completed at the estimated cost.

12. If a channel of the projected dimensions were completed, it is the opinion of the Board that lake vessels would not make general use of it. Most freight hauled upon the river would be transshipped at Grand Haven. To insure the operation of through transportation lines between Grand Rapids and Chicago, Milwaukee, and other lake ports, would require a channel from 200 to 300 feet wide and 15 to 16 feet deep. Such a channel would cost several millions of dollars, a sum out of proportion to general benefits that would result.

13. If a ship channel such as that last referred to be out of the question, it remains to be considered whether a channel suited to barges and river steamers would be advisable, and to determine the proper dimensions and cost of such a channel.

14. In the case of so short a haul as from Grand Rapids to Grand Haven, the cost of loading and unloading bears a large ratio to the total cost of transportation. The great manufacturing plants at Grand Rapids are generally provided with railroad switches, and are not situated upon the river bank. It would be much cheaper for these plants to load in cars than to haul to the river and load there. There would be some objection to the rehandling at Grand Haven of such shipments as furniture, especially when, if sent by rail, they could be shipped in carload lots.

15. It is apparent, then, that the traffic of a barge or river steamboat channel would be largely confined to small-lot shipments of articles not easily breakable, destined for lake ports or western points reached from lake ports by rail, and to such bulky articles as lumber and coal and plaster. The use of any such light-draft channel would depend upon the business arrangements that could be made by carriers on the river for the exchange of freight with lake carriers.

16. If it be true that any reasonable improvement of Grand River

must be based upon the idea of transshipment at Grand Haven, and if it be true, as indicated in the two preceding paragraphs, that no considerable portion of the commerce of Grand Rapids would follow such a channel under any circumstances, it follows that no large amount of money should be expended to reduce by a small fraction of a mill per ton-mile the cost of carriage upon Grand River. The Board believes, therefore, that a 6-foot channel would accomplish for the community in and about Grand Rapids practically as much as a 10-foot channel.

17. Grand Rapids has a population of about 100,000 and is believed to be the leading furniture city of the world. It has 532 factories, employing 20,474 persons. The annual output of these factories is valued at nearly $45,000,000. Grand Rapids has also a very important jobbing trade, amounting to $21,000,000 annually. The freight tonnage in and out of Grand Rapids annually is estimated at 2,267,000.

18. The following table is derived from information furnished the Board by the Grand Rapids Board of Trade. It shows the tonnage of various articles comprising the traffic between Grand Rapids and lake ports or other points that can be most economically reached via the lake route:

| | Tons. |
|---|---|
| Plaster and stucco | 50,000 |
| Furniture | 3,898 |
| Carpet sweepers | 143 |
| Opera chairs | 1,045 |
| Church furniture | 1,568 |
| School seats | 2,614 |
| Ball bats and croquet sets | 520 |
| Felt boots | 923 |
| Woodworking machinery | 881 |
| Excelsior | 1,300 |
| Refrigerators | 900 |
| Veneers | 1,932 |
| Leather | 2,635 |
| Beans | 380 |
| Anthracite coal from Buffalo | 60,000 |
| Lumber, from Wisconsin and upper Michigan ports, 6,000,000 feet | 10,000 |
| Iron, I beams, pipes, and castings, from Chicago | 62,000 |
| Beer, from Milwaukee | 3,700 |
| Liquors in wood, from Peoria, via Chicago | 1,120 |
| Wool, from Illinois and Wisconsin | 184 |
| Packing boxes, from Manitowoc | 736 |
| Hides, from Chicago and west | 4,620 |
| Broom corn, from Chicago | 112 |
| Lard, pork, and staple groceries, from Chicago | 25,000 |
| Canned corn, from Manitowoc | 750 |
| Tobacco, from Chicago and Milwaukee | 800 |
| Zinc | 113 |
| Veneers | 1,821 |
| Total | 239,695 |

19. The cost of a 6-foot channel 100 feet wide, from Fulton street, in Grand Rapids, to Grand Haven, Mich., as estimated from data furnished by the district officer, is as follows:

| | |
|---|---|
| Dredging, sand, 862,408 cubic yards, at 14 cents | $120,737.12 |
| Dredging, hard material, 464,373 cubic yards, at 25 cents | 116,093.25 |
| Dredging, hard material, including winding basin at upper end of work, difficult to dispose of, 250,000 cubic yard, at 35 cents | 87,500.00 |
| Training walls | 25,000.00 |
| Dam at Fulton street | 20,175.00 |
| Contingencies and administration | 60,494.63 |
| Total | 430,000.00 |

20. There is now available in plant and cash for the prosecution of work under the present project about $103,000. If there be no further legislative action regarding Grand River, this amount will be practically wasted. There would remain to be appropriated, to produce a 6-foot channel, the sum of $327,000. The above estimate is based upon the supposition that the entire amount be made available for work with the United States plant not later than one year hence.

21. The cost of maintaining a 6-foot channel may be estimated at $20,000 per annum, as compared with $30,000 for maintaining a 10-foot channel.

22. A study of the movements of commerce to and from Grand Rapids leads the Board to believe that benefits more than commensurate with the cost would follow the securing and efficient maintenance of a 6-foot channel. It is believed that freight rates upon a part of the rail-borne commerce of Grand Rapids would be lowered, and that a fair amount of business would be done upon the river itself. The Board, therefore, believes that it is advisable to modify the project for the improvement of Grand River, with a view to securing and maintaining a 6-foot channel, 100 feet wide, from Fulton street, Grand Rapids, to Grand Haven, Mich., at a cost of $327,000, in addition to plant and funds now available.

Respectfully submitted.

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers.*
EDW. BURR,
*Major, Corps of Engineers.*
C. H. MCKINSTRY,
*Captain, Corps of Engineers.*
W. V. JUDSON,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

## M M 8.

### IMPROVEMENT OF MUSKEGON HARBOR, MICHIGAN.

The history of this improvement to the close of the last fiscal year is found in the Report of the Chief of Engineers for 1903, pages 1958–1960.

### OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

The dredging in progress at the beginning of the fiscal year under the contract with the Lydon & Drews Company was completed on July 9, and resulted in restoring a depth of 18 feet for the full width of the channel at entrance, and for a width of 120 feet between the projecting part of the piers. The quantity dredged in July was 8,350 cubic yards, and since the beginning of the work on June 18, 1903, 27,215 cubic yards, and the price per cubic yard was 16¼ cents.

Contractor Robert Love continued operations begun in the previous fiscal year for revetting the unprotected portion of the bank on the south side of the channel from the inner end of the south pier to Muskegon Lake, and for repairing the south pier between stations 6+28.8 and 9+33, and completed the same on November 28. The first section of the new revetment begins at the former east end of the south pier, station 3+04 E., and extends thence for a distance of 1,016 feet to station 13+20 E. It consists of two rows of round piles 15 feet apart between centers, the distance between the centers of the piles of the front row being 4 feet and of those of the rear row 8 feet; of a wall of triple-sheet piles, composed of 4, 3, and 2 inch planks, in the rear of the front round piles and united with the same by means of guide timbers at the top and 10 feet below the top; binding timbers and screw bolts, of a wale on both front and rear piles and iron tie-rods connecting them every 8 feet; of a timber superstructure 4 feet high in the front wall and 2 feet high in the rear wall, with cross-ties 8 feet apart between centers, and with a plank walk 3 feet wide on top. The top of the superstructure is 4 feet above the level of zero of gauge. The work is stiffened by sand filling back of the sheet piles and reaching to the top of the same. From station 3+04 to 3+15 an opening is arranged through the superstructure for the convenience of the Life-Saving Service.

The second section extends from station 22+60 to station 35+62, a distance of 1,297 feet. From station 22+65 to station 35+12 it is a sheet-piled construction built upon the same plans as the first section. The part from station 35+12 to station 35+62 is a crib 50 feet long and 24 feet wide, resting on a pile foundation and with the top of the superstructure 4 feet above the level of zero of gauge. The crib forms the end of the revetment in Muskegon Lake. The space above water between the horns at the east end was filled with a solid timber structure, a mooring post was built into the crib, and after the completion of the stone filling the crib was decked over.

The repairs of the south pier between stations 6+28.8 and 9+33 consisted in removing the old timber work above the level of zero of gauge, repairing the substructure where necessary, building a new superstructure 6 feet high, returning the old stone filling to the work, and decking it over.

The Barry Brothers Transportation Company having declined to make repairs themselves of the part of the south pier between stations 14+91.5 and 15+06.5, damaged by their steamer *F. & P. M. No. 1* on October 27, 1900, the repairs were made under the direction of this office by purchased material and hired labor, and the cost collected from the owners of the steamer through the United States district attorney.

An informal contract was entered into with Leathem & Smith Towing and Wrecking Company for refilling portions of the south pier, but the work has not yet been done.

On November 12 the steam barge *Osceola*, of Duluth, while attempting to turn, struck the north revetment and ruined it between stations 4+63 and 5+50 E. As this revetment has long been in bad condition, and besides, as the existing project provides for its entire removal, no steps have been taken to have the ruined part repaired.

The foregoing operations cost as follows:

| | |
|---|---|
| Construction of revetment, under contract with Robert Love | $39,017.09 |
| Repair of pier, under contract with Robert Love | 2,537.96 |
| Dredging, under contract with the Lydon & Drews Company | 1,377.75 |

### CONDITION OF WORK JUNE 30, 1904.

The north pier and revetment is 2,780 feet long, and consists of 1,176 feet of pile work and 1,604 feet of cribwork. The project provides for the removal of the easterly 1,826 feet of the existing structure when the interior channel is widened to 300 feet. Of the remaining outer portion about 350 feet are 18 to 19 years old and will soon need a new superstructure. The rest is in good condition. The two sections of the south pier and revetment have an aggregate length of 4,402 feet and consist of 2,947 feet of pile work and 1,455 feet of cribwork. The pier is generally in good or fair condition, but 250 feet is now 20 years old and will soon need new superstructure, and the filling in a portion of the cribwork has settled greatly. The south bank of the interior channel between the east end of the Government revetment at station 13+20 and the car-ferry slip was formerly used by the Pere Marquette Railroad Company as a landing for their steamers, and a warehouse occupied it for nearly the entire distance mentioned. This use has now been discontinued, the warehouse has been removed, and the unprotected bank, about 400 feet in length, is being abraded by the waves and the material washed into the channel.

Soundings of May 20–23 showed the following available depths: Outside, 24.4 feet on line of south pier, 17.1 feet 100 feet north of that line, 18.2 feet 200 feet north, and 20.2 feet on line of north pier; at outer end of piers, 20 to 26 feet near south pier, 18.2 feet in mid-channel, and 20 to 23 feet near north pier; 500 feet inside of end of south pier there was 18 feet for width of 100 feet next to south pier, and 17.3 feet in mid-channel; opposite the angle in north pier, 300 feet outside of shore line, a depth of 16 feet was found for 70 feet width next to south pier, and thence to Muskegon Lake 17 feet in mid-channel.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The vacancies in the pockets of the south pier cribs will be refilled with stone under the informal contract with Leathem & Smith at an estimated cost of $1,000. Dredging is required at the entrance and near shore line to restore the customary width and depth of channel, and this will be done when one of the dredges of Contractor Samuel O. Dixon becomes available. The balance of the available funds will be reserved for ordinary repairs and contingencies.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $604,500.00 |
| Miscellaneous receipts | | 110.00 |
| | | 604,610.00 |
| Total amount expended on project, 1866, amended 1869, 1873, 1881, 1884, 1890, 1892, and 1899: | | |
| For construction | $388,218.42 | |
| For maintenance | 138,074.94 | |
| | | 526,293.36 |
| Total amount expended on project approved June 13, 1902: | | |
| For construction | 47,810.33 | |
| For maintenance | 16,475.92 | |
| | | 64,286.25 |
| Balance | | 14,030.39 |
| Original estimated cost of work, 1866, amended in 1869, 1873, 1881, 1884, 1890, 1892, and 1899 | | 596,000.00 |
| Estimated cost revised project approved June 13, 1902 | | 380,000.00 |

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $71,350.48 |
| Deposit, November 9, 1903 | | 110.00 |
| | | 71,460.48 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $47,810.33 | |
| For maintenance of improvement | 9,619.76 | |
| | | 57,430.09 |
| July 1, 1904, balance unexpended | | 14,030.39 |
| July 1, 1904, outstanding liabilities | | 25.42 |
| July 1, 1904, balance available | | 14,004.97 |
| July 1, 1904, amount covered by uncompleted contracts | | 5,000.00 |
| Amount (estimated) required for completion of existing project | | 305,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $254,100.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 264,100.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

## APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 2, 1867 | $59,000 | August 5, 1886 | $12,500 |
| July 11, 1870 | 10,000 | August 11, 1888 | 45,000 |
| March 3, 1871 | 15,000 | September 19, 1890 | 50,000 |
| June 10, 1872 | 10,000 | July 13, 1892 | 75,000 |
| June 23, 1874 | 10,000 | August 18, 1894 | 30,000 |
| March 3, 1875 | 25,000 | June 3, 1896 | 30,000 |
| August 14, 1876 | 15,000 | March 3, 1899 | 60,000 |
| March 3, 1879 | 5,000 | June 6, 1900 (allotments) | 5,500 |
| June 14, 1880 | 7,500 | June 13, 1902 | 75,000 |
| March ?, 1881 | 20,000 | Miscellaneous receipts | 110 |
| August 2, 1882 | 25,000 | | |
| July 5, 1884 | 20,000 | Total | 604,610 |

## ABSTRACT OF CONTRACTS IN FORCE.

### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

### *Construction of revetment and repair of pier.*

Contractor: Robert Love.
Date of contract: November 4, 1902.
Date of approval: November 15, 1902.
Date of beginning: April 15, 1903.
Date of expiration: December 1, 1903.

Rates: Cutting down and removing old work, $2.50 per linear foot; dredging, 35 cents per cubic yard; foundation piles, 50 cents per linear foot; white-oak piles, 30 cents per linear foot; white-oak timber, $40 per M feet B. M.; longleaf yellow-pine timber, $30 per M feet B. M.; hemlock timber, $25 per M feet B. M.; longleaf yellow-pine plank for sheet piles, $38 per M feet B. M.; longleaf yellow-pine plank for decking, $27 per M feet B. M.; driftbolts, screw bolts, carriage bolts, tie-rods, and spikes, 3 cents per pound; stone, $7.50 per cord; sand filling, 20 cents per cubic yard.

### *Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

### COMMERCIAL STATISTICS FOR MUSKEGON HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the deputy collector of customs at Muskegon, Mich.]

| Character of vessels. | Number. | Tonnage. |
|---|---|---|
| Steam | 941 | 623,821 |
| Sail | 230 | 26,521 |
| Total | 1,171 | 650,342 |

Maximum draft, 17 feet.

### *Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Coal | 7,853 | Beans | 1 |
| Grain | 1,325 | Coal | 5,145 |
| Lumber, shingles, etc | 30,695 | Corn | 28 |
| Merchandise, miscellaneous | 43,006 | Flour | 4 |
| Salt | 42 | Fruit | 104 |
| Stone | 1,680 | Lumber, slabs, etc | 40,331 |
| | | Merchandise, miscellaneous | 44,139 |
| Total | 84,601 | Total | 89,752 |

| | Tons. |
|---|---|
| Total freight carried in 1902 | 227,013 |
| Total freight carried in 1903 | 174,353 |
| Decrease | 52,660 |

## M M 9.

## IMPROVEMENT OF HARBORS AT PENTWATER AND WHITE LAKE, MICHIGAN.

These harbors were formerly carried as separate works, but are now combined in consequence of the requirements of the river and harbor act of June 13, 1902.

The history of these works is brought to July 1, 1903, in the Report of the Chief of Engineers for 1903, pages 1962–1964.

## OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

### (A) PENTWATER HARBOR.

Contractors Burk, Smith & Nelson began operations on the repairs of the north pier between stations 12+84 and 21+74 on July 28. What remained of the old superstructure was removed and the piles sawed off at the level of zero of gauge. The leaning piles in front row between stations 21+30 and 21+74 were pulled out, and the front wall of the substructure was rebuilt by driving 15 new piles 3 feet between centers. The east end wall was also restored by driving 7 new piles. Many piles of the rear row were found to be so rotten as to render them unserviceable, and 41 new piles were driven to take their places. A new front wale was put in place and connected with the rear wall by iron tie-rods at distances of 8 feet between each other. The new superstructure is 5 feet high in front wall and 3 feet high in the rear wall, with cross-ties 8 feet center to center. The serviceable portion of the old filling was replaced in the work, and a plank walk 3 feet wide built on top. Between stations 19+49 and 19+74.5 the revetment is interrupted by a ferry slip. The contract was completed October 8.

Between August 8 and 17 the channel between the piers and on the outer bar was dredged under the contract with the Lydon & Drews Company, resulting in an available channel 120 feet wide and 17 feet deep across the bar and 60 feet wide and 14 feet deep between the piers. The dredged quantity was 11,337 cubic yards, and the price per cubic yard was 16.5 cents.

The foregoing operations cost as follows:

| | |
|---|---|
| Repair of pier, under contract with Burk, Smith & Nelson | $8,127.72 |
| Dredging, under contract with the Lydon & Drews Company | 1,870.61 |

### (B) WHITE LAKE HARBOR.

Operations under the contract with Burk, Smith & Nelson for repairing the north pier, between stations 0 and 0 + 45 E., and for refilling the pile piers on both sides of the channel, were continued and finally completed on September 30. The work done on the north pier, between stations 0 and 0 + 45, consisted in putting in the 5 tie-rods passing from the front wale to the first course of the rear wall of the new superstructure. The refilling of the north pile pier, between stations 0 + 45 and 15 + 15, was completed by adding 112.7 cords brush, restoring 66 cords old stone, and putting in 174.93 cords new stone ballast. Eight cords brush were added to the filling of the south pier between stations 7 + 23 and 7 + 90, and 3 cords of old stone and 12 cords of new stone between stations 7 + 23 and 8 + 40.

The channel was dredged between July 10 and 23 under the contract with the Lydon & Drews Company, resulting in a channel 120 feet wide across the bar, 90 feet wide at end of piers, and 60 feet wide inside, with a depth of not less than 14 feet. The material removed was 12,359 cubic yards, and the cost per cubic yard 16.5 cents.

The foregoing operations cost as follows:

| | |
|---|---|
| Repair of piers, under contract with Burk, Smith & Nelson | $1,898.47 |
| Dredging, under contract with the Lydon & Drews Company | 2,039.24 |

### CONDITION OF WORK JUNE 30, 1904.

The timber work of the piers at Pentwater is in good or fair condition, except at the outer end of the north pier, where the substructure has settled away from the superstructure, and at the inner end of the first crib, where there is a large hole below water in the front wall. The filling in the pile work of both piers has settled greatly and needs replenishing. The following are the available depths as shown by the soundings made May 28–31: On the line of north pier, outside and 50 feet south of that line, 14.2 feet, and on line of south pier 11 feet; in channel between piers, 15 feet for width of 50 feet next to north pier at outer end, and 11 feet in south half of channel; 400 feet from outer end of north pier there was 13.4 feet for 50 feet width next to that pier, and thence 14 feet in mid-channel to Pentwater Lake.

The works at White Lake are in fair condition, except 105 feet of crib work in the south pier, which is 21 years old and will require a new superstructure before long. Soundings made May 25–27 showed the following available depths: Outside, 16.2 feet on line of south pier, 16.5 feet 60 feet north of that line, 13 feet 120 feet north, and 11.4 feet on line of north pier. In channel between the piers there was 15 feet for 60 feet width next to the south pier at its outer end, and 12.2 feet in mid-channel on the shoalest section 400 feet inside of outer end of the pier.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The channel at each harbor will be dredged for the temporary restoration of the required depth of navigation as soon as the dredges employed under the existing contract with Samuel O. Dixon become available. Of the remaining funds $500 for each harbor has been reserved as part payment of an inspection steamer, and the remaining balances will be applied to ordinary repairs and such additional dredging as may become necessary.

#### PENTWATER HARBOR.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $293, 820. 00 |
| Total amount expended on project of 1867, amended in 1873, 1884, and 1892: | | |
| For construction | $179, 873. 15 | |
| For maintenance | 108, 118. 36 | |
| | | 287, 991. 51 |
| Balance | | 5, 828. 49 |
| Original estimated cost, 1867, amended 1873, 1884, and 1892 | | 327, 713. 40 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $16,197.73 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 10,369.24 |
| July 1, 1904, balance unexpended | | 5,828.49 |
| July 1, 1904, outstanding liabilities | | 30.53 |
| July 1, 1904, balance available | | 5,797.96 |
| July 1, 1904, amount covered by uncompleted contracts | | 3,000.00 |
| Amount (estimated) required for completion of existing project | | 22,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $22,000.00 | |
| For maintenance of improvement | 20,000.00 | |
| | | 42,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

WHITE LAKE HARBOR.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $339,550.00 |
| Total amount expended on project, 1866, amended in 1873, 1884, 1892, and 1898: | | |
| For construction | $207,862.44 | |
| For maintenance | 127,532.87 | |
| | | 335,395.31 |
| Balance | | 4,154.69 |
| Original estimated cost, 1866, amended in 1873, 1884, 1892, and 1898 | | 353,550.00 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $11,404.88 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 7,250.19 |
| July 1, 1904, balance unexpended | | 4,154.69 |
| July 1, 1904, outstanding liabilities | | 12.59 |
| July 1, 1904, balance available | | 4,142.10 |
| July 1, 1904, amount covered by uncompleted contracts | | 2,000.00 |
| Amount (estimated) required for completion of existing project | | 18,100.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $18,100.00 | |
| For maintenance of improvement | 12,000.00 | |
| | | 30,100.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

## APPROPRIATIONS.

| Date. | Pentwater. | White Lake. | Total. |
|---|---|---|---|
| March 2, 1867 | $55,000 | $57,000 | $112,000 |
| April 10, 1869 (allotment) | 17,820 | 44,550 | 62,370 |
| July 11, 1870 | 10,000 | 20,000 | 30,000 |
| March 3, 1871 | 10,000 | 20,000 | 30,000 |
| June 10, 1872 | 30,000 | 10,000 | 40,000 |
| March 3, 1873 | 20,000 | 7,000 | 27,000 |
| June 23, 1874 | .......... | 10,000 | 10,000 |
| March 3, 1875 | .......... | 10,000 | 10,000 |
| August 14, 1876 | 10,000 | 5,000 | 15,000 |
| June 18, 1878 | 10,000 | 12,000 | 22,000 |
| March 3, 1879 | 6,000 | 7,500 | 13,500 |
| June 14, 1880 | 4,000 | 5,000 | 9,000 |
| March 3, 1881 | 10,000 | 7,500 | 17,500 |
| August 2, 1882 | 10,000 | 12,000 | 22,000 |
| July 5, 1884 | 15,000 | 10,000 | 25,000 |
| August 5, 1886 | 10,000 | 10,000 | 20,000 |
| August 11, 1888 | 8,000 | 10,000 | 18,000 |
| September 19, 1890 | 8,000 | 17,000 | 25,000 |
| July 13, 1892 | 5,000 | 5,000 | 10,000 |
| August 18, 1894 | 5,000 | 5,000 | 10,000 |
| June 3, 1896 | 5,000 | 5,000 | 10,000 |
| March 3, 1899 | 25,000 | 35,000 | 60,000 |
| June 13, 1902 (allotments) | 20,000 | 15,000 | 35,000 |
| Total | 293,820 | 339,550 | 633,370 |

## ABSTRACT OF CONTRACTS IN FORCE.

### HARBOR AT PENTWATER.

*Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

*Repair of north pier.*

Contractor: Burk, Smith & Nelson.
Date of contract: March 13, 1903.
Date of approval: March 24, 1903.
Date of beginning: August 1, 1903.
Date of expiration: November 15, 1903.
Rates: Cutting down and removing old work, $2 per linear foot; white oak piles, 40 cents per linear foot; white oak timber, $50 per M feet B. M.; white pine, long-leaf yellow pine or Douglas fir timber, $32 per M feet B. M.; white pine or long-leaf yellow pine planks, $30 per M feet B. M.; driftbolts, 3½ cents per pound; screw bolts, tie-rods, and spikes, 4 cents per pound.

*Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

### HARBOR AT WHITE LAKE.

*Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

*Repair of piers.*

Contractor: Burk, Smith & Nelson.
Date of contract: March 20, 1903.
Date of approval: April 8, 1903.
Date of beginning: August 1, 1903.
Date of expiration: November 15, 1903.
Rates: Cutting down and removing old work, $3 per linear foot; white oak piles, $1 per linear foot; white oak timber, $50 per M feet B. M.; white pine, long-leaf yellow pine, or Douglas fir timber, $34 per M feet B. M.; white pine or long-leaf yellow pine planks for decking, $30 per M feet B. M.; driftbolts, screw bolts, tie-rods, and spikes, 4 cents per pound; edgings or brush, $4 per cord; stone, $6.50 per cord.

*Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

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### COMMERCIAL STATISTICS FOR PENTWATER HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the village president at Pentwater, Mich.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 880 | 51,988 |
| Sail | 188 | 10,836 |
| Total | 1,068 | 62,824 |

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Lumber, shingles, etc | 363 | Fruit | 7,100 |
| Merchandise, miscellaneous | 8,312 | Lumber, shingles, etc | 3,680 |
| | | Potatoes | 1,421 |
| | | Merchandise, miscellaneous | 1,364 |
| Total | 8,675 | Total | 13,565 |

## M M 10.

## IMPROVEMENT OF HARBOR AT LUDINGTON, MICHIGAN.

The history of this improvement is brought to the beginning of the fiscal year in Report of Chief of Engineers for 1903, pages 1966–1968.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

Operations on the extension and repairs of the piers and revetments under the contract with T. J. Bennett & Co. were continued. A general description of the same is as follows: The extension of the north pier, under this contract, consists of 4 cribs, each 100 feet long and 30 feet wide, the 3 first cribs being 18½ feet and the last 22½ feet high, with a continuous superstructure 6 feet high. Each crib rests on a foundation of 84 piles. Crib No. 2 was sunk in its place on August 14, crib 3 on September 1, and crib 4 on October 31. The first 5 courses and all but 108 linear feet of the 6th course of the superstructure were completed. The north wall of the adjacent old work, which had been damaged at a former time, and the outer end of the new work, which was damaged by a car ferry last winter, were repaired. Five mooring posts were secured in place, and the 12 guard piles at the outer end were driven. The total extension of the pier amounts to 400.5 linear feet, and the top of the new work is about 6 feet above the level of zero of gauge. The extension of the south pier consists of one crib, 100 feet long, 30 feet wide, and 22½ feet high, sunk on a pile foundation on July 16, and completed by a superstructure 6 feet high. Two mooring posts were secured in the work, the 12 guard piles at the outer end were driven, and the 3 horizontal guard timbers were put in place; the stone filling was completed, and 40 linear feet of the decking was secured. The sides and end of the crib were protected with 120 cords of stone riprap. The resulting extension of the piers is 100.1 feet. The level of the top of the superstructure is about 6 feet above zero of gauge. The north revetment, between stations 0 and 5+88, is practically completed, the only remaining work being the completion of the plank walk and the upsetting of some bolts and tie-rods. The work during the year consisted in driving 23 front piles, 7 rear piles, and 590 compound sheet piles, of which latter 12 are in the cross wall at the east end. The upper and lower guide, binding timber, front and rear wales, the tie-rods, and the superstructure 4 feet high in front and 2 feet high in the rear, with cross-ties 8 feet between centers, were built for the whole length of the work. The sand filling behind the sheet piles, which was completed, amounted to about 3,428 cubic yards. An opening for the convenience of the Life-Saving Service was left in the superstructure between stations 5+23.5 and 5+38.5. The end of the old work adjacent to the new revetment, which had been damaged by colliding vessels, was repaired at the same time. The repairs of the south revetment, between stations 0 and 5+67, were also practically completed. The cap on the old front piles was put in place from station 0+63.3 to station 0+02, the cap on the old rear piles from station 0+99.5 to station 0, and the guide timber from station 0+76.6 to station 0+02. Five hundred and seventy-one compound sheet piles, 13 of which are in the cross wall at the east end, 141 round piles in the front wall, and 4 round piles in the rear wall, to replace broken ones between stations 0+25 and 0+01, were driven, and the upper and lower binder, the front wale, and the superstructure 4 feet high in the front and 2 feet high in the rear wall, were completed over the entire length of the work. The front wale was connected with the rear wall by 71 iron tie-rods, and a plank walk 3 feet wide was laid on top of the structure. An opening through the superstructure between stations 5+01 and 5+16 was left for the convenience of the Life-Saving Service. The revetment was run into and damaged by one of the car ferries on March 4. The required repairs have been made by the contractors. Nothing remains for the final completion of this section but the upsetting of some bolts and tie-rods. The repairs of the north pier between stations 12+37 and 14+98 are in the same state of completion. The old work was cut down to the level of zero of gauge, the site of the sheet piles was dredged for the removal of obstructions, the substructure repaired where required, the guide timber put in place, and 97 compound sheet piles and 25 round piles driven between stations 12+39 and 13+39, and secured by the upper and lower binders, front wale, and 13 tie-rods. The new superstructure, 6 courses high, and the decking were completed over the entire section. Little work was done on the repairs of the south pier between stations 11+73 and 16+79.5 before the close of the season of 1903, but 67 round piles were driven along the front wall between stations 11+73 and 14+23 and temporarily bolted to the old work to counteract a tendency of the cribs to settle toward the channel. Since the resumption of operations this spring, the repairs have been pushed with greater vigor, and at the end of the fiscal year the old timbers above grade were removed between stations 11+73 and 15+30, defective portions of the substructure were repaired, and the piles previously driven secured by front wale and 31 iron tie-rods. The front wall of the superstructure, beginning at station 11+70.5, was completed to station 15+18.5 in the first course, to station 14+92.5 in the second course, to station 14+84.5 in the third course, to station 14+54.5 in the fourth course, to station 13+58.5 in the fifth course, and to station 13+50.5 in the sixth course, and the rear wall, beginning at station 11+73, to station 14+92.5 in the first course, to station 14+84.5 in the second course, to station 14+54.5 in the third course, to station 14+46.5 in the fourth course, to station 13+58.5 in the fifth course, and to station 13+50.5 in the sixth course. The decking was put in place from station 11+85.5 to station 12+65.5 after the return of the old stone filling to this part of the pier.

Between August 19 and September 8 the channel was dredged under the contract with the Lydon & Drews Company, restoring a depth of 19 feet for the full width within lines 30 feet from either pier. The dredged quantity was 24,246 cubic yards, and cost per cubic yard 16.5 cents.

The Pere Marquette Railroad Company repaired the various parts of the piers damaged by its steamers during recent years.

The foregoing operations cost as follows:

| | |
|---|---|
| Pier extension, under contract with T. J. Bennett & Co | $56,370.48 |
| Repair of piers and revetments, under contract with T. J. Bennett & Co. | 19,887.72 |
| Dredging, under contract with the Lydon & Drews Company | 4,000.60 |

## CONDITION OF WORK JUNE 30, 1904.

Upon the completion of the work under contract with T. J. Bennett & Co. the piers and revetments of the entrance channel will be in good condition, with the exception of the stone filling in crib intervals and some pockets of the projecting parts of the piers. The north bank immediately east of the new revetment just constructed has been seriously abraded by the waves running in through the improved channel during westerly storms, and complaints have been received that at such times vessels can not safely lie at the docks of the Pere Marquette Railroad Company on the east shore of Pere Marquette Lake, in front of the entrance.

The condition of the channel was ascertained by soundings made June 1-2, as follows: The depth outside in front of the entrance was

19.1 to 19.6 feet, with 18.2 feet on the line of the north pier and 18.1 feet on the line of the south pier. Between the piers there was a depth of 18 feet for a width of 120 feet in mid-channel. The depths refer to the level of zero of gauge. The stage of the lake at the time of soundings was 0.0 to −0.1 foot.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

After the completion of the work now under contract with T. J. Bennett & Co. there will remain the further extension of the north pier by 300 feet and of the south pier by 200 feet, for the completion of all the work of pier construction provided for by the adopted project. The estimated cost of this extension is $68,750. The sum of $83,800 has been set aside for partly paying for the hydraulic dredge now under contract and originally intended for use at the harbors composing this district. This sum is ultimately to be returned to the funds available for improving Ludington Harbor, and it will then be possible to complete the project for pier extension. Under date of December 15, 1903, alternative plans intended to afford relief from the wave action during westerly storms on vessels lying at the docks of the Pere Marquette Railroad Company, opposite the entrance, were submitted to the Chief of Engineers. The first plan proposed to remove the inner section, 588 and 567 feet long, respectively, of the two piers, to widen the channel 50 feet on each side, and to protect the same with new revetments. This plan was estimated to involve an outlay of $50,000. The second plan proposed an extension of the north revetment by 250 feet and the construction of an interior breakwater 100 feet long and 24 feet wide, projecting into Pere Marquette Lake, for which the estimate was $18,000. This latter plan, if adopted, could be carried into execution with the available funds, after the return to the harbor appropriation of the amount used to pay for the hydraulic dredge, and the remaining balance would be sufficient to pay for incidental repairs and for such dredging as may be needed for the maintenance of the navigable condition of the channel.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

The estimate for maintenance by dredging and repairs is $10,000.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $653,435.00 |
| Less amount carried to surplus fund | | .90 |
| | | 653,434.10 |
| Total amount expended on project, 1867, amended 1885, 1889, 1890, and 1899: | | |
| For construction | $391,528.62 | |
| For maintenance | 107,203.16 | |
| | | 498,731.78 |
| Balance | | 154,702.32 |
| Original estimated cost of work, 1867, revised 1890 | | 381,682.00 |
| Estimated cost of modified project approved March 3, 1899 | | 210,000.00 |

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $234,519.73 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $57,352.87 | |
| For maintenance of improvement | 22,464.54 | |
| | | 79,817.41 |
| July 1, 1904, balance unexpended | | 154,702.32 |
| July 1, 1904, outstanding liabilities | | 139.36 |
| July 1, 1904, balance available | | 154,562.96 |
| July 1, 1904, amount covered by uncompleted contracts | | 27,703.11 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | | 10,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

#### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 2, 1867 | $50,000.00 | August 5, 1886 | $56,250.00 |
| April 10, 1869 (allotment) | 31,185.00 | August 11, 1888 | 60,000.00 |
| July 11, 1870 | 10,000.00 | July 13, 1892 | 5,000.00 |
| March 3, 1871 | 10,000.00 | August 18, 1894 | 6,000.00 |
| June 10, 1872 | 10,000.00 | June 3, 1896 | 25,000.00 |
| March 3, 1873 | 25,000.00 | March 3, 1899 | 25,000.00 |
| June 23, 1874 | 20,000.00 | June 13, 1902 | 75,000.00 |
| March 3, 1875 | 10,000.00 | March 3, 1903 | 165,000.00 |
| August 14, 1876 | 10,000.00 | | |
| June 18, 1878 | 15,000.00 | Total | 653,435.00 |
| March 3, 1879 | 5,000.00 | Amount carried to the surplus fund, 1872 | .90 |
| June 14, 1880 | 8,000.00 | | |
| March 3, 1881 | 10,000.00 | | 653,434.10 |
| August 3, 1882 | 12,000.00 | | |
| July 5, 1884 | 10,000.00 | | |

#### ABSTRACT OF CONTRACTS IN FORCE.

##### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

##### *Extension and repair of piers.*

Contractor: T. J. Bennett & Co.
Date of contract: November 8, 1902.
Date of approval: November 28, 1902.
Date of beginning: April 15, 1903.
Date of expiration: Decembor 31, 1903. (Time limit waived.)

Rates: Cutting down and removing old work, $2.10 per linear foot; dredging, 50 cents per cubic yard; foundation piles, 60 cents per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $48 per M feet B. M.; white-pine timber, $30.90 per M feet B. M.; hemlock timber, $21 per M feet B. M.; longleaf yellow-pine plank for sheet piles, $38 per M feet B. M.; white-pine plank for decking, $28 per M feet B. M.; driftbolts and spikes, 3 cents per pound; screw bolts, 3¼ cents per pound; carriage bolts, 4 cents per pound; tie-rods, 3½ cents per pound; stone, $6.75 per cord; sand filling, 16 cents per cubic yard.

*Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

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### COMMERCIAL STATISTICS FOR LUDINGTON HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the deputy collector of customs at Ludington, Mich.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 3,249 | 4,699,023 |
| Sail | 191 | 22,268 |
| Total | 3,440 | 4,721,291 |

Maximum draft, 18 feet.

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Merchandise, miscellaneous | 184,904 | Merchandise, miscellaneous | 170,813 |
| Cement | 3,824 | Bark | 5,070 |
| Copper | 20,753 | Cement | 5,577 |
| Feed | 13,130 | Coal | 292,834 |
| Flour | 93,328 | Flour | 400 |
| Grain | 194,762 | Fruit | 3,365 |
| Hay | 1,638 | Grain | 807 |
| Iron | 10,288 | Iron | 25,418 |
| Leather | 703 | Leather | 598 |
| Lumber | 206,477 | Lumber | 40,855 |
| Malt | 23,043 | Potatoes | 127 |
| Pease and beans | 1,810 | Salt | 49,307 |
| Poles | 465 | Stone | 404 |
| Potatoes | 427 | Sugar | 1,969 |
| Stone | 1,602 | Wood | 7,917 |
| Wooden ware | 243 | | |
| Total | 757,397 | Total | 605,461 |

| | Tons. |
|---|---|
| Total freight carried in 1903 | 1,362,858 |
| Total freight carried in 1902 | 1,341,712 |
| Increase | 21,146 |

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## M M 11.

## IMPROVEMENT OF HARBOR AT MANISTEE, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1903, pages 1970–1971.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

T. J. Bennett & Co., the contractors for the extension of the south pier, completed the construction of the single crib required for this contract at Ludington during the season of 1903. During May, 1904, active operations were begun at Manistee. The site for the crib was dredged to the required depth, the 124 foundation piles were driven and sawed off at the proper level, the crib was towed from Ludington to Manistee and sunk in its place on June 23. The 12 protection piles for the outer end were driven. The crib is 150 feet long, 30 feet wide and 16½ feet deep. It is to be completed with a six-course superstructure.

Between July 24 and August 4 the channel between the piers near the shore line was dredged under the contract with the Lydon & Drews Company for a width of 90 feet and length of 140 to 210 feet to the depth of 19 feet; the channel at the bend, near the inner end of the north revetment, for a width of 90 feet and length of 200 to 570 feet to the depth of 18 feet; the channel in the river between stations 20+50 and 28 for a width of 60 feet to the depth of 18 feet, and the channel between stations 30+50 and 33+50, and between 34+10 and 35 was widened by a cut 30 feet wide and 18 feet deep. The Manistee authorities objected to the dredging between the river stations 34+10 and 35, apprehending injury to the water pipe and electric cable crossing the river at this point. The dredging resulted in a channel 90 feet wide and 17 feet deep between the piers, and 60 feet wide and 16 feet deep in the river as far as Oak street, where the deepening was interrupted. The depth at this point was 14 to 14.7 feet in May, 1903, when the previous soundings were made, and this, consequently, was the maximum available depth for vessels using the harbor above that point. The dredged quantity was 15,083 cubic yards and the cost per cubic yard 16.5 cents.

On November 12 the steamer *Hennepin*, of Milwaukee, towed by the tug *3rd Mich.*, while entering struck the north pier near station 8+15, breaking three courses of the front wall and the top course of the rear wall.

The Manistee and Northeastern Railroad Company, who occupy the north revetment between the inner end and station 7+60, made some slight repairs to the work between stations 7+60 and 6+47.5.

The foregoing operations cost as follows:

| | |
|---|---|
| Pier extension, under contract with T. J. Bennett & Co. | $9,167.82 |
| Dredging, under contract with the Lydon & Drews Company | 2,488.70 |

## CONDITION OF WORK JUNE 30, 1904.

The piers and revetments are in fair condition, except for some breaks in the north pier, due to collisions, and that the filling in many pockets has settled considerably. A portion of the south pier 100 feet in length is twenty to twenty-two years old.

The condition of the channel was ascertained by soundings made June 9 to 11 to be as follows: Outside, the depth on the line of the north pier was 20 feet, diminishing to 19.6 feet 70 feet south of that line, to 18.3 feet 140 feet south, and to 17 feet on the line of the south pier; 200 feet inside of the end of the south pier there was a depth of 16 feet for a width of 100 feet next to the north pier, the depth diminishing to 13.4 feet nearer to the south pier; farther in the middle of the channel afforded a depth of 16 feet for a width of 60 feet to the inner end of the north revetment; thence to Maple Street Bridge the line of best water afforded a depth of 15.4 feet, and from there to Manistee Lake 15 feet. The depths refer to the level of zero of gauge. The stage of the lake at the time of soundings varied from +0.1 to −0.1 foot.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The work now in progress for the extension of the south pier by a crib 150 feet long will be completed. Of the available funds $10,000 have been allotted as part payment of the new hydraulic dredge and $1,000 are reserved as allotment for the purchase of an inspection steamer. The remainder will be reserved for dredging during the season of 1904 for repairs and for contingencies. When the allotment for the hydraulic dredge is returned to the credit of the harbor it will be possible to arrange for the further extension of the south pier, which will complete the approved project, as far as new construction is concerned.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

The estimate is simply for maintenance by repairs and dredging, and for this purpose $15,000 are asked.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $437,000.00 |
| Total amount expended on project 1866, amended 1871, 1875, 1890, 1892, 1898, and 1901: | | |
| For construction | $314,785.43 | |
| For maintenance | 89,933.97 | |
| | | 404,719.40 |
| Balance | | 32,280.60 |
| Original estimated cost of work, 1866, amended in 1871, 1875, 1890, 1892, 1898, and 1901 | | 428,000.00 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $44,404.19 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $9,557.22 | |
| For maintenance of improvement | 2,566.37 | |
| | | 12,123.59 |
| July 1, 1904, balance unexpended | | 32,280.60 |
| July 1, 1904, outstanding liabilities | | 215.00 |
| July 1, 1904, balance available | | 32,065.60 |
| July 1, 1904, amount covered by uncompleted contracts | | 7,786.72 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | | 15,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

### APPROPRIATIONS.

| | |
|---|---|
| March 2, 1867 | $60,000 |
| July 11, 1870 | 20,000 |
| March 3, 1871 | 9,000 |
| June 10, 1872 | 10,000 |
| March 3, 1873 | 10,000 |
| June 23, 1874 | 10,000 |
| March 3, 1875 | 25,000 |
| August 14, 1876 | 14,000 |
| June 18, 1878 | 15,000 |
| March 3, 1879 | 10,000 |
| June 14, 1880 | 10,000 |
| March 3, 1881 | 10,000 |
| August 2, 1882 | $15,000 |
| July 5, 1884 | 10,000 |
| August 5, 1886 | 10,000 |
| August 11, 1888 | 10,000 |
| September 19, 1890 | 50,000 |
| July 13, 1892 | 50,000 |
| August 18, 1894 | 12,000 |
| June 3, 1896 | 15,000 |
| March 3, 1899 | 20,000 |
| June 13, 1902 | 42,000 |
| Total | 437,000 |

### ABSTRACT OF CONTRACTS IN FORCE.

#### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903; approved May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

#### *Extension of south pier.*

Contractor: T. J. Bennett & Co.
Date of contract: November 14, 1902.
Date of approval: December 4, 1902.
Date of beginning: April 15, 1903.
Date of expiration: November 1, 1903. (Time limit waived.)
Rate: Dredging, 40 cents per cubic yard; foundation piles, 50 cents per linear foot; white oak guard piles, 34 cents per linear foot; white oak timber, $48 per M feet B. M.; white pine timber, $30.90 per M feet B. M.; hemlock or Norway pine timber, $21 per M feet B. M.; white pine plank, $27 per M feet B. M.; driftbolts, screw bolts, and spikes, 3 cents per pound; stone, $6.25 per cord.

#### *Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

### COMMERCIAL STATISTICS FOR MANISTEE HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the deputy collector of customs at Manistee, Mich.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 1,768 | 800,344 |
| Sail | 431 | 70,983 |
| Total | 2,199 | 871,327 |

Maximum draft, 15 feet.

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Merchandise, miscellaneous | 9,209 | Merchandise, miscellaneous | 8,772 |
| Brick | 33 | Apples | 122 |
| Coal | 3,240 | Bark | 7,456 |
| Flour | 81 | Fish | 85 |
| Grain | 4,268 | Iron | 30 |
| Hay | 286 | Lumber | 195,974 |
| Iron | 23 | Potatoes | 1,116 |
| Stone | 6,510 | Salt | 328,172 |
| Ties | 180 | Shingles | 330 |
| Vinegar | 19 | Wood | 4,455 |
| Total | 23,849 | Total | 546,512 |

| | Tons. |
|---|---|
| Total freight carried in 1902 | 812,259 |
| Total freight carried in 1903 | 570,361 |
| Decrease | 241,898 |

New line established during year: Manistee, Ludington and Milwaukee Transportation Company, between Manistee, Ludington, and Milwaukee, doing a general passenger and freight business.

## M M 12.

## HARBOR OF REFUGE AT PORTAGE LAKE, MANISTEE COUNTY, MICHIGAN.

The history of this improvement to the beginning of the year is found in the Report of the Chief of Engineers for 1903, pages 1973–1974.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

At the beginning of the fiscal year operations were in progress under the contract with the Fitz Simons & Connell Company for dredging a channel 180 feet wide and 18 feet deep at low water between the piers from Lake Michigan to Portage Lake. These operations were continued until November 3, resumed April 27, and finally completed June 20. There were six through cuts, each 30 feet wide and 20 feet deep, and varying in length from 2,165 to 2,645 feet, and an additional cut 220 feet long was made next to the most northerly cut at its outer end for the removal of a shoal spot. Portions of the fourth and fifth cuts, which had been completed in 1903, were redredged in 1904, in order to restore their original depth. Besides, a cut 30 feet wide and 14 feet deep was made along the face of the south pier between its east end and station 7+80 for the removal of obstructions from the site of the sheet piles to be driven in connection with the proposed repairs of that part of the pier. The quantity dredged during the fiscal year was 183,521 cubic yards, making the total quantity removed under this contract since the beginning of work in June, 1903, 207,925 cubic yards, and the cost per cubic yard was 12¼ cents.

Work on the repairs of the south pier between its east end and station 7+71 was begun early in May under the contract with T. J. Bennett & Co. At the end of the fiscal year the cutting down to grade of the old structure had been completed, as well as the putting in place of the cap on the old front piles, the guide timber, and the rear wale. Besides, 90 compound sheet piles had been driven, extending from station 7+70.3 to station 6+78.5, the upper binder was secured from station 7+69 to station 6+82.5, and 8 front piles were driven between stations 7+63.5 and 7+21.5.

The foregoing operations cost as follows:

| | |
|---|---|
| Dredging under contract with the Fitz Simons & Connell Company | $25,990.62 |
| Repair of pier, under contract with T. J. Bennett & Co | 2,350.60 |

### CONDITION OF WORK JUNE 30, 1904.

Upon the completion of the repairs of the part of the south pier between the east end and station 7+71, which are now in progress under the contract with T. J. Bennett & Co., the piers and revetments will be in good condition.

The condition of the channel, as ascertained by the soundings of June 16–18, was as follows: Outside there was a depth of 18.2 feet in front of the middle of the entrance, but the available depth on the line of the north pier was 21.9 feet, and on the line of the south pier 21 feet. About 800 feet inside of outer end of south pier a shoal extended from the north pier with 13.4 feet near that pier and deepening to 18 feet in the middle of the channel. South of the middle of the channel there was a width of 90 feet with a depth of 18 feet. Farther inside the width of the 18-foot channel was 180 feet. The depths refer to the level of zero of gauge. The stage of the lake was about zero of gauge. Considerable shoaling appears to have taken place since the dredging of the past season, which was no doubt caused principally by the leveling action of the waves on the banks left on each side of the dredged channel; and this condition will continue until the entire width of the channel shall have been dredged to the projected depth.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

Operations on the repairs of the interior 787 feet of the south pier will be completed under the contract with T. J. Bennett & Co. Of the balance of available funds, $500 is to be used in part payment of an inspection steamer, and what remains will be used as part payment of the new hydraulic dredge and for contingencies.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

With the repairs of the south pier now under way the work will be in excellent condition. For the proper maintenance of the channel it will be necessary to reduce the high banks which remain between it and the piers. This will require the removal of an estimated quantity of 100,000 cubic yards, at a cost of $17,500. The estimate for ordinary repairs is $5,000, making the total estimate for maintenance $22,500.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $369,500.00 |
| Total amount expended on project, 1879, amended in 1890, 1898, and 1899: | | |
| For construction | $244,129.21 | |
| For maintenance | 94,091.77 | |
| | | 338,220.98 |
| Balance | | 31,279.02 |
| Original estimated cost of work, 1879, amended 1890, 1898, and 1899 | | 344,300.00 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $58,100.61 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 26,821.59 |
| July 1, 1904, balance unexpended | 31,279.02 |
| July 1, 1904, outstanding liabilities | 140.46 |
| July 1, 1904, balance available | 31,138.56 |
| July 1, 1904, amount covered by uncompleted contracts | 14,608.35 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 22,500.00 |

### APPROPRIATIONS.

| | |
|---|---|
| March 3, 1879 | $10,000 |
| June 14, 1880 | 10,000 |
| March 3, 1881 | 10,000 |
| August 2, 1882 | 25,000 |
| July 5, 1884 | 12,500 |
| August 5, 1886 | 15,000 |
| August 11, 1888 | 10,000 |
| September 19, 1890 | 8,000 |
| August 18, 1894 | $25,000 |
| June 3, 1896 | 25,000 |
| March 3, 1899 | 75,000 |
| June 6, 1900 | 85,000 |
| June 13, 1902 | 59,000 |
| Total | 369,500 |

### ABSTRACT OF CONTRACTS IN FORCE.

#### *Dredging.*

Contractor: The Fitz Simons & Connell Company.
Date of contract: April 23, 1903.
Date of approval: May 26, 1903.
Date of beginning: June 13, 1903.
Date of expiration: December 1, 1903. (Time limit waived.)
Rate: 12½ cents per cubic yard.

#### *Repair of south pier.*

Contractor: T. J. Bennett & Co.
Date of contract: April 17, 1903.
Date of approval: May 13, 1903.
Date of beginning: Not earlier than April 1 nor later than May 1, 1904.
Date of expiration: Five months from date of beginning and not later than October 1, 1904.

Rates: Cutting down and removing old work, $1 per linear foot; white-oak piles, 33 cents per linear foot; white-oak timber, $45 per M feet B. M.; white pine, long leaf yellow pine, or Douglas fir timber, $32 per M feet B. M.; white pine, long leaf yellow pine, or Douglas fir planks for sheet piles, $40 per M feet B. M.; white pine or long leaf yellow pine planks for decking, $30 per M feet B. M.; driftbolts, 3½ cents per pound; screw bolts, tie-rods, and spikes, 3½ cents per pound; carriage bolts, 4½ cents per pound.

## M M 13.

## IMPROVEMENT OF FRANKFORT HARBOR, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1903, pages 1975–1976.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

At the beginning of the fiscal year operations were in progress under the contract with T. J. Bennett & Co. for extending the north pier 200 feet, and for repairing the south pier between stations 10+84.2 and 12+87.2. The two cribs for the extension of the north pier, each 100 by 24 by 18½ feet, were built at Ludington, and No. 1 was towed to Frankfort on July 24 and No. 2 on August 13. The pile foundation for crib 2 was completed, and crib 1 was sunk in its place on August 10 and No. 2 on September 5. A continuous superstructure, 6 feet high, was built over the cribs, 4 mooring posts were put in place, the space between the end horns was filled with 10 guard piles and 3 horizontal protection timbers, the structure was filled with stone to the top, and decked over. The end of the outer crib was protected with 20 cords of heavy riprap. On January 7 the Ann Arbor Railroad Company's car ferry *No. 1* damaged the end of the pier. The injury was repaired by the contractors before final acceptance of their work. The linear extension of the pier is 200 feet, and the top of the superstructure is about 6 feet above the level of zero of gauge. For the repairs of the south pier between stations 10+84.2 and 12+87.2, the remainder of the old structure above the level of zero of gauge was removed, and a new superstructure 6 feet high was built in its place. The old stone filling was restored to the work and the decking was put in place. A break in the channel wall of the pier between stations 10+63.9 and 10+86.2 caused by the contractor's stone scow was repaired. The lake side pockets of the six outer cribs of the south pier were refilled with stone. The contract was completed in May, 1904.

Dredging operations under the contract with the Lydon & Drews Company were begun August 12, and completed September 5, and resulted in restoring a depth of 19 feet for the full width of channel at entrance, and for the same depth inside within lines 30 feet from either pier. The quantity dredged amounted to 25,112 cubic yards, and the price per cubic yard was 16½ cents.

Under date of September 5 the Secretary of War granted permission to the Frankfort Hotel Company to occupy 800 linear feet of the north pier from the inner end to station 8, on condition that they put in mooring posts and keep the pier in good repair.

The foregoing operations cost as follows:

| | |
|---|---|
| Pier extension, under contract with T. J. Bennett & Co | $18,272.53 |
| Repair of pier, under contract with T. J. Bennett & Co | 3,590.69 |
| Dredging, under contract with the Lydon & Drews Company | 4,143.48 |

### CONDITION OF WORK, JUNE 30, 1904.

The north pier, which has been extended 200 feet during the past fiscal year, is generally in good condition. The 186 feet of pile work at the inner end of the south pier is practically ruined in consequence of being run into by the car ferries of the Ann Arbor Railroad Company. About 43 feet of the front wall and 17 feet of the rear wall at the east end are gone entirely, while 44 feet more have canted over into the channel, and the remainder of the superstructure is unserviceable. Such damage is of constant occurrence, and in the past it has been customary for the railroad company to make the necessary repairs at its own expense. The rest of the south pier is in fair condition.

Soundings made June 20 showed an available depth of 17.1 feet outside in front of the entrance, 17.2 feet in the middle of the channel at end of piers with better water on either side, and 20 feet in the middle of the channel thence to the inner lake. The depths refer to the level of zero of gauge. The stage of the lake at the time of soundings was 0.0 to −0.1 foot.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

As soon as a dredge becomes available under the contract with Samuel O. Dixon, the channel at entrance and between the piers will be redredged for the restoration of the required width of the navigation. Of the remaining balance, $10,000 has been set aside as part payment of the new hydraulic dredge, and the remainder will be reserved for additional dredging and incidental repairs.

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $438,159.85 |
| Less amount covered into Treasury | | 5,721.50 |
| | | 432,438.35 |
| Total amount expended on project of 1866, amended in 1868, 1879, 1892, 1898, and 1899: | | |
| For construction | $311,459.02 | |
| For maintenance | 100,741.88 | |
| | | 412,200.90 |
| Balance | | 20,237.45 |
| Original estimated cost of work, 1866, amended 1868, 1879, 1892, 1898, and 1899 | | 421,938.35 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $49,317.06 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $20,252.03 | |
| For maintenance of improvement | 8,827.58 | |
| | | 29,079.61 |
| July 1, 1904, balance unexpended | | 20,237.45 |
| July 1, 1904, outstanding liabilities | | 7.38 |
| July 1, 1904, balance available | | 20,230.07 |
| July 1, 1904, amount covered by uncompleted contracts | | 4,000.00 |
| Amount (estimated) required for completion of existing project | | 22,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $22,000.00 | |
| For maintenance of improvement | 15,000.00 | |
| | | 37,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

## APPROPRIATIONS.

| | |
|---|---|
| Aux Becs Scies, Michigan: | |
| June 23, 1866 | $88,541.00 |
| March 2, 1867 | 10,000.00 |
| July 25, 1868 (allotment) | 10,000.00 |
| April 10, 1869 (allotment) | 29,318.85 |
| July 11, 1870 | 10,000.00 |
| March 3, 1871 | 10,000.00 |
| Frankfort, Mich.: | |
| June 10, 1872 | 10,000.00 |
| March 3, 1873 | 10,000.00 |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 10,000.00 |
| August 14, 1876 | 3,000.00 |
| June 18, 1878 | 8,800.00 |
| March 3, 1879 | 4,000.00 |
| June 14, 1880 | 5,000.00 |
| March 3, 1881 | 10,000.00 |
| Frankfort, Mich.—Cont'd. | |
| August 2, 1882 | $15,000.00 |
| July 5, 1884 | 5,000.00 |
| August 5, 1886 | 7,000.00 |
| August 11, 1888 | 8,000.00 |
| September 19, 1890 | 10,000.00 |
| July 13, 1892 | 10,000.00 |
| August 18, 1894 | 50,000.00 |
| June 3, 1896 | 15,000.00 |
| March 3, 1899 | 35,000.00 |
| June 13, 1902 | 54,500.00 |
| Total | 438,159.85 |
| Amount covered into the Treasury (Report, 1871, p. 133) | 5,721.50 |
| | 432,438.35 |

## ABSTRACT OF CONTRACTS IN FORCE.

### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903.
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

### *Extension and repair of piers.*

Contractor: T. J. Bennett & Co.
Date of contract: April 17, 1903.
Date of approval: May 13, 1903.
Date of beginning: May 15, 1903.
Date of expiration: September 15, 1903. (Time limit waived.)
Rates: Dredging, 60 cents per cubic yard; cutting down and removing old work, $2 per linear foot; white-oak piles, 35 cents per linear foot; foundation piles, 60 cents per linear foot; white-oak timber, $45 per 1,000 feet B. M.: white-pine, long-leaf yellow-pine, or Douglas fir timber, $32 per 1,000 feet B. M.; hemlock or Norway pine timber, $22.50 per 1,000 feet B. M.; white-pine or long-leaf yellow-pine planks, $30 per 1,000 feet B. M.; driftbolts, screw bolts, and spikes, 3¼ cents per pound; stone, $6.20 per cord. Removing the projecting east end of north pier, lump sum of $100 (this last item annulled by supplemental contract dated May 21, 1903).

### *Dredging.*

Contractor: Samuel O. Dixon.
Date of contract: March 25, 1904.
Date of approval: April 15, 1904.
Date of beginning: May 3, 1904.
Date of expiration: September 17, 1904.
Rate: 17½ cents per cubic yard.

COMMERCIAL STATISTICS FOR FRANKFORT HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the deputy collector of customs at Frankfort, Mich.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 1,556 | 2,004,742 |
| Sail | 205 | 19,906 |
| Total | 1,761 | 2,024,648 |

Maximum draft, 18 feet.

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Feed | 90 | Fruit | 96 |
| Flour | 5 | Freight cars, loaded | 376,670 |
| Freight cars, loaded | 529,900 | Freight cars, empty | 6,465 |
| Freight cars, empty | 1,365 | Lumber | 14,630 |
| Hay | 98 | Sawdust | 520 |
| Oats | 118 | Ties | 1,158 |
| Stone | 3,219 | Vegetables | 51 |
| | | Wood, bark, slabs, etc | 14,502 |
| Total | 534,795 | Total | 414,092 |

| | Tons. |
|---|---|
| Total freight carried in 1903 | 948,887 |
| Total freight carried in 1902 | 948,647 |
| Increase | 240 |

## M M 14.

## IMPROVEMENT OF HARBOR AT CHARLEVOIX, MICHIGAN.

The history of this work to the beginning of the year is found in the Report of the Chief of Engineers for 1903, pages 1978–1979.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

Operations under the contract with Archibald J. Beauvais for repairing the north pier between stations 14+22.7 and 17+25.4 and the south pier between stations 15+26.6 and 17+77.9, both on the lower channel, and the north revetment of the upper channel were begun July 23. The repairs of the piers of the lower channel were completed in November, and it is probable that those on the upper channel would also have been completed within the time limit of the contract but for the greatly increased amount of material and labor required in consequence of the washing away of part of the substructure of the north revetment. On this account the completion of the contract was delayed until June 11, operations having been suspended from December 11 to May 14. The repairs of the piers of the lower channel consisted in removing the old timbers above the level of zero of gauge, repairing the substructure where required, building a new superstructure 6 feet high in the north pier and 5 feet high in the south pier, returning the old stone filling to the work, and in putting on the decking. The end pockets of the south pier were also partially refilled. When work was to begin on the proposed repairs to the north revetment of the upper channel it was found that a great number of the piles of the substructure were lost and that the filling also was much worse than had been anticipated. A special agreement was therefore concluded with the contractor for the restoration of the substructure, which required 62 new piles in the front wall, 3 new piles in the rear wall, and 3 new piles at the west end. The remainder of the old work was cut down to the level of 1 foot below zero of gauge and a new superstructure 4 feet high in the front wall and 3 feet high in the rear wall was built, the front piles of the substructure were protected with an oak wale, and the revetment was refilled with 58 cords brush and 49 cords edgings, ballasted with 21 cords stone.

Between July 25 and August 5 the outer portion of the lower channel was dredged under the contract with the Lydon & Drews Company, with the result that a channel 90 feet wide and 18 feet deep at the entrance and a channel 60 feet wide and 16 feet deep between the piers was restored. The dredged material measured 10,510 cubic yards, and the cost was 16½ cents per cubic yard.

Under date of February 3, 1904, permission was granted to the Charlevoix Summer Home Association to occupy as a landing for passenger steamers 45 feet of the west end of the south revetment between Pine Lake and Round Lake, on condition that the association keep the revetment in substantial repair.

On May 15 the steam barge *Three Brothers*, of Buffalo, owned by William H. White & Co., of Boyne City, Mich., ran into the south pier at the outer end, breaking the timbers to the depth of 12 feet below the top at the end of the pier and for a distance of 30 feet from the end in the top course. The boat also damaged the old front wall of the north pier between stations 11+65 and 11+95, which serves to support the elevated walk to the light on the end of the pier. The latter damage was repaired by the United States Light-House authorities.

The cost of the foregoing operations was as follows:

| | |
|---|---|
| Repair of piers and revetment under contract with Archibald J. Beauvais. | $10,087.64 |
| Dredging, under contract with the Lydon & Drews Company............ | 1,734.15 |

## CONDITION OF WORK JUNE 30, 1904.

In the lower channel the north revetment from station 0 to station 9+45 is a complete wreck. The interior portion, 345 feet in length, has been used by the owners of the land behind it as a landing place for vessels and for purposes of transshipping freight, and it should be repaired by them at their expense. From station 9+45 to the outer end the pier is in good condition. The south pier, with the exception of the damaged outer end, is also in good condition. In the upper channel the north revetment has just been repaired and is in good condition. The south revetment is in bad condition.

Soundings made June 23–25 showed the following available depths: Outside of the lower channel there was 17.4 feet in front of the middle of the entrance, 16.1 feet on the line of the north pier, and 14.4 feet on the line of the south pier. Between the piers of the lower channel there was 16.5 feet available in mid-channel and in the channel from Round to Pine Lake 17.4 feet. The depths refer to the level of zero of gauge. The stage of the lake at the time of soundings was 0.0 to −0.1 foot.

## WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

There is nothing proposed, on account of the small amount of the remaining balance.

## ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

About 600 feet of the north revetment need complete reconstruction, the south revetment of the upper channel should be rebuilt above the water surface, and all the structures require considerable filling. The approved project provides for an extension of 200 feet to the south pier, at an estimated cost of $19,800. The estimate is therefore as follows:

| | |
|---|---|
| To complete the project, 200 feet extension to south pier, at $99 | $19,800 |
| For maintenance: | |
| Rebuilding about 600 feet north revetment (lower channel) | 15,000 |
| Rebuilding revetment (upper channel) | 9,150 |
| Miscellaneous small repairs and refilling | 4,000 |
| Dredging | 5,000 |
| Total | 52,950 |

As provided in section 14 of the river and harbor act of June 13, 1902, and in pursuance of the directions of the Chief of Engineers dated June 23, 1902, a special report was submitted to the Chief of Engineers under date of October 3, 1902, upon a preliminary examination of Charlevoix Harbor, Michigan, "with a view to obtaining a channel 18 feet in depth from Lake Michigan to Pine Lake."

| | | |
|---|---|---|
| Total amount appropriated and allotted to June 30, 1904 | | $175,500.00 |
| Total amount expended on project of 1868, amended in 1876 and 1884: | | |
| For construction | $80,205.04 | |
| For maintenance | 93,211.91 | |
| | | 173,416.95 |
| Balance | | 2,083.05 |
| Original estimated cost 1868, amended 1876 and 1884 | | 184,000.00 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $13,437.56 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 11,354.51 |
| July 1, 1904, balance unexpended | 2,083.05 |
| July 1, 1904, outstanding liabilities | 65.84 |
| July 1, 1904, balance available | 2,017.21 |
| July 1, 1904, amount covered by uncompleted contracts | 1,445.38 |

| | | |
|---|---|---|
| Amount (estimated) required for completion of existing project | | 19,800.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $19,800.00 | |
| For maintenance of improvement | 33,150.00 | |
| | | 52,950.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | |
|---|---|
| August 14, 1876 | $10,000 |
| June 18, 1878 | 12,000 |
| March 3, 1879 | 9,000 |
| June 14, 1880 | 10,000 |
| March 3, 1881 | 10,000 |
| August 2, 1882 | 10,000 |
| July 5, 1884 | 10,000 |
| August 5, 1886 | 10,000 |
| August 11, 1888 | 12,500 |
| September 19, 1890 | $9,000 |
| July 13, 1892 | 10,000 |
| August 18, 1894 | 8,000 |
| June 3, 1896 | 20,000 |
| March 3, 1899 | 15,000 |
| June 13, 1902 | 20,000 |
| Total | 175,500 |

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### ABSTRACT OF CONTRACTS IN FORCE.

#### *Dredging.*

Contractor: The Lydon & Drews Company.
Date of contract: March 26, 1903.
Date of approval: May 6, 1903,
Date of beginning: May 24, 1903.
Date of expiration: October 9, 1903.
Rate: 16½ cents per cubic yard.

#### *Repair of piers and revetment.*

Contractor: Archibald J. Beauvais.
Date of contract: March 26, 1903.
Date of approval: April 13, 1903.
Date of beginning: August 1, 1903.
Date ef expiration; November 15, 1903. (Time limit waived.)

Rates: Cutting down and removing old work, $2 per linear foot; white oak timber, $50 per M feet, B. M,; white pine, long-leaf yellow pine, or Douglas fir timber, $32 per M feet, B. M.; white pine or long-leaf yellow pine planks, $30 per M feet, B. M.; driftbolts and screw bolts, 3½ cents per pound; spikes, 4 cents per pound; stone, $6 per cord; edgings, $2.50 per cord.

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### COMMERCIAL STATISTICS FOR CHARLEVOIX HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by the deputy collector of customs at Charlevoix, Mich.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 304 | 58,870 |
| Sail | 342 | 61,850 |
| Total | 646 | 120,720 |

Maximum draft, 16.3 feet.

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Beer | 55 | Apples | 8 |
| Bricks | 213 | Bark | 1,520 |
| Coal | 3,880 | Barrels, empty | 46 |
| Feed | 100 | Horses | 9 |
| Grain | 1,540 | Logs | 147 |
| Lumber | 1,652 | Lumber | 98,564 |
| Piles | 210 | Posts | 1,242 |
| Merchandise, miscellaneous | 2,000 | Ties | 5,400 |
| | | Merchandise, miscellaneous | 1,000 |
| Total | 9,650 | Total | 107,936 |

| | Tons. |
|---|---|
| Total freight carried in 1902 | 245,977 |
| Total freight carried in 1903 | 117,586 |
| Decrease | 128,391 |

## M M 15.

## IMPROVEMENT OF HARBOR AT PETOSKEY, MICHIGAN.

The previous history of this improvement to the beginning of the year is found in the Report of the Chief of Engineers for 1903, pages 1981-1982.

### OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1904.

A contract was entered into on July 2, 1903, with A. J. Beauvais & Co. for removing the north breakwater and extending the west breakwater 300 feet, the extension to consist of the two cribs removed from the north breakwater and of one new crib 100 feet long, 30 feet wide, and 22½ feet high, resting on a stone foundation and provided with a continuous superstructure 3 and 4 feet high, the work to begin May 1 and to be completed November 1, 1904.

Actual operations were begun June 13, the contractors having been delayed at Charlevoix Harbor, where the work under their contract for repairing the piers and revetments was not completed until June 11. Since then they have removed 106.3 cords large stone from the slopes of the foundation of the north breakwater and 57.4 cords from the filling of that structure, and deposited the same in the foundation of the extension of the west breakwater. The cost of the foregoing operations was $690.95.

### CONDITION OF WORK JUNE 30, 1904.

Upon completion of the work now under contract with A. J. Beauvais & Co. the works at this harbor will consist of a westerly breakwater about 901 feet long, consisting of 200 feet of stonework and 701 feet of cribwork. A break now existing in the lake wall of the present end crib will be closed up under the contract now in force. When the work above mentioned is completed, the breakwater will be in good condition.

### WORK PROPOSED FOR FISCAL YEAR ENDING JUNE 30, 1905.

The work under the contract with A. J. Beauvais & Co. will be completed.

### ESTIMATE OF FUNDS FOR FISCAL YEAR ENDING JUNE 30, 1906.

A further extension of the west breakwater will unquestionably prove necessary after the removal of the north breakwater. An estimate is therefore furnished for an extension of 200 feet, and also for the necessary maintenance, viz:

| | | |
|---|---|---|
| 200 feet extension of west breakwater, at $150 | | $30,000.00 |
| Repairs | | 3,000.00 |
| Total | | 33,000.00 |
| Total amount appropriated to June 30, 1904 | | 88,000.00 |
| Total amount expended on project of 1894, amended in 1902: | | |
| For construction | $53,201.10 | |
| For maintenance | 2,378.68 | |
| | | 55,579.78 |
| Balance | | 32,420.22 |
| Original estimated cost of work, 1894 | | 170,000.00 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $32,464.67 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | | 44.45 |
| July 1, 1904, balance unexpended | | 32,420.22 |
| July 1, 1904, outstanding liabilities | | 84.33 |
| July 1, 1904, balance available | | 32,335.89 |
| July 1, 1904, amount covered by uncompleted contracts | | 27,744.93 |
| Amount (estimated) required for completion of existing project | | 82,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $30,000.00 | |
| For maintenance of improvement | 3,000.00 | |
| | | 33,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

---

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| September 19, 1890 | $15,000 | March 3, 1899 | $20,000 |
| July 13, 1892 | 20,000 | June 13, 1902 | 15,000 |
| August 18, 1894 | 10,000 | | |
| June 3, 1896 | 8,000 | Total | 88,000 |

### ABSTRACT OF CONTRACTS IN FORCE.

*Extension of west breakwater.*

Contractors: A. J. Beauvais & Co.
Date of contract: July 2, 1903.
Date of approval: July 28, 1903.
Date of beginning: Any time prior to May 1, 1904.
Date of expiration: November 1, 1904.

Rates: Removing north breakwater cribs and stone filling and replacing same in west breakwater, lump sum of $8,250; white oak timber, $60 per M; white pine, long-leaf yellow pine, or Douglas fir timber, $35 per M; white pine or long-leaf yellow pine timber for deck, $34 per M; hemlock or Norway pine timber, $28.50 per M; driftbolts and screw bolts, 4 cents per pound; spikes, 5 cents per pound, stone, $6.50 per cord.

### COMMERCIAL STATISTICS FOR PETOSKEY HARBOR, MICHIGAN, CALENDAR YEAR ENDING DECEMBER 31, 1903.

[Compiled from statement furnished by Mr. E. A. Weston, agent for Northern Michigan Transportation Company.]

| Character of vessel. | Number. | Tonnage. |
|---|---|---|
| Steam | 1,955 | 324,700 |
| Sail | 162 | 16,200 |
| Total | 2,117 | 340,900 |

*Receipts and shipments by vessel, 1903.*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Fish | 350 | Fruit | 125 |
| Flour, feed, etc | 280 | Lumber | 7,000 |
| Fruit and vegetables | 120 | Vegetables | 375 |
| Machinery, pipe, etc | 1,200 | Wooden ware | 350 |
| Merchandise, miscellaneous | 120,000 | Merchandise, miscellaneous | 1,000 |
| Total | 121,950 | Total | 8,850 |

## M M 16.

## SURVEY OF ARCADIA HARBOR, MICHIGAN.

[Printed in House Doc. No. 194, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith report dated October 29, 1902, by Capt. Charles Keller, Corps of Engineers, on survey of Arcadia Harbor, Michigan, with estimate of cost for maintaining piers and channel, made in pursuance of a requirement of the river and harbor act approved June 13, 1902. Arcadia Harbor lies at the north end of Bar Lake, which connects with Lake Michigan by a channel between parallel piers created and maintained by private enterprise.

Captain Keller presents a plan for thoroughly rebuilding the piers at an estimated cost of $90,390 and $5,200 annually for maintaining the piers and dredging the channel, but in his judgment, for reasons stated, this expenditure is not justifiable. He is of opinion, however, that the locality is worthy of improvement to the extent of maintaining the present channel, by dredging only, at a cost of $3,000 annually for a period of five years. The views of Captain Keller are concurred in by the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers, and by the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act.

I concur in the opinion of the Board as expressed in its report of April 15, 1903.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF CAPT. CHARLES KELLER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Grand Rapids, Mich., October 29, 1902.*

GENERAL: I have the honor to submit the following report of a survey made at Arcadia Harbor, Michigan, in compliance with the requirements of section 14 of the river and harbor act of June 13, 1902, which directs the preparation of an estimate of the cost of maintaining piers and channel. The duty of preparing this estimate was assigned to me by letter from the Office of the Chief of Engineers dated June 23, 1902, and by Department letter of August 8, 1902, for the purpose of making the necessary survey, there was allotted the sum of $200 from the appropriation for examinations, surveys, and contingencies provided for in the act above mentioned.

Previous knowledge of this harbor is derived from the report of a preliminary examination "with a view to obtaining a channel 150 feet wide and 14 feet deep," made in compliance with the requirements of the river and harbor act of March 3, 1899, by my predecessor, Capt. Chester Harding, Corps of Engineers, and printed upon pages 3942-3946 of the Annual Report of the Chief of Engineers for 1900. Reference is invited to Captain Harding's report for his opinion as to the merits of Arcadia Harbor.

In the accompanying report of Mr. C. W. H. Smith, junior engineer, who made, under my direction, the survey which was necessary for the intelligent preparation of the required estimate of cost of maintaining piers and channel, is given a full account of the history of Arcadia Harbor, of its present and prospective commercial importance, and of the nature and condition of the harbor works. As stated in Mr. Smith's report, Arcadia is an unincorporated village of about 400 inhabitants. It is at the north end of Bar Lake, which is 18 miles north of Manistee Harbor, 9 miles north of Portage Lake Harbor, and 11 miles south of Frankfort Harbor.

The chief industries are a sawmill and dimension-stock factory with 58 employees, a veneer and basket factory with 65 employees, and a planing and feed mill combined. The sawmill is in operation practically the entire year, and has a daily capacity of 38,000 feet B. M. of hardwood or 80,000 feet B. M. of hemlock. In addition the village has a number of stores, the most important of which, together with the above mills and practically all of the dock property, are owned by the Henry Starke Land and Lumber Company. Arcadia has communication with the interior by means of the Arcadia and Betsey River Railroad, 21 miles long, which connects with the Pere Marquette Railroad at Henry, 17 miles from Arcadia, and with the Ann Arbor Railroad and the Manistee and Northeastern Railroad at Copemish, the eastern terminus of the road itself.

Three boats run regularly to Arcadia. One is a steam barge, the *Arcadia*, 119 feet long and drawing 11.5 feet loaded, which is owned by the Henry Starke Land and Lumber Company and used by them to carry their lumber to western markets. The others are small steamers, the *John D. Dewar*, 72 feet long, and the *Liberty*, 97 feet long, which run along the shore between Frankfort and Manistee, stopping at Arcadia twice each day.

Communication with Lake Michigan is through Bar Lake and through a dredged channel created and maintained by private enterprise, at an expense to date, as stated, of about $56,000. The depths in the Bar Lake channel are ample, but the artificial outlet into Lake Michigan requires constant dredging.

The principal commerce tributary to this harbor is derived from the shipment of lumber, wood, and allied products, and amounts at present to from 23,500 to 29,000 tons annually. Receipts of water-borne freight are inconsiderable in amount, so that it is apparent that the value of this harbor is dependent upon the one-way freight originating from the lumber industry. Such small general commerce as exists depends upon and will largely cease with the same industry, which probably will not continue for more than twenty years to come.

The harbor structures are inefficient in type and built of the most perishable varieties of timber. For the proper maintenance of the harbor and to reduce to a minimum the cost of the necessary periodical dredging both piers must be practically rebuilt throughout, and the north pier must be extended at least 300 feet, so as to bring its outer end opposite the outer end of the south pier. At present the north pier terminates about at the 10-foot contour, a condition that renders shoaling excessive. At the time of the survey, as shown by the map[a] herewith, the available depth was between 12 and 12.5 feet in a narrow and rather difficult channel, and this depth is subject to considerable further diminution due to the usual lowering of the lake surface during the months of October to April, inclusive, and to the seas which are prevalent during the same months. As a matter of fact, probably less than 10 feet may safely be counted on at this harbor throughout the year, but this depth, if reliably maintained, seems ample.

To rebuild the piers so as to render them sand tight and to extend the north pier the estimate is as follows:

| | |
|---|---|
| 1,120 linear feet sheet pile revetment, at $22 | $24,640 |
| 1,300 linear feet pile pier, at $27.50 | 35,750 |
| 300 linear feet cribwork for pier extension, at $100 | 30,000 |
| Total | 90,390 |

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[a] Not printed.

After the piers have been rebuilt the average annual cost for maintenance of the structures will be about $1 per foot of length, or about $2,700; while, based upon past experience at this harbor and others in the vicinity, the cost of maintaining the channel by dredging will probably be not less than $2,500 annually. The average annual "cost of maintaining the piers and channel" will therefore be $5,200; but this figure is based upon antecedent thorough rebuilding of all structures, and is liable to be more than doubled in the absence of early appropriation of its estimated cost ($90,390).

The commercial interests to be served by these expenditures are at present small in amount and local in character. Personal examination of the locality shows that future development will be slow and not extensive. Under the circumstances, the expenditure of $90,000 in rebuilding and extending the piers and of $2,700 annually upon their maintenance does not, in my judgment, seem justifiable.

On the other hand, expenditures for dredging only will permit the maintenance of this harbor for such general commerce as now exists and may hereafter arise, and for the next five years such expenditure should not exceed $2,500 to $3,000 annually. At the end of that time a growth sufficient to warrant further and larger expenditure will have manifested itself or else it will have become evident that future expenditures are unwarranted. In view of the fact, therefore, that a small general traffic does exist, and because it is believed that private interests should not be taxed for even this relatively small general good, I have the honor to state that for a limited period of five years, and to the extent of $3,000 annually, I regard Arcadia Harbor as worthy of being maintained at the expense of the United States by dredging only.

Attention is invited to the very complete report of Mr. C. W. H. Smith, junior engineer, who made the necessary survey and examination under my direction.

Very respectfully, your obedient servant,

CHARLES KELLER,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., November 6, 1902.*

Respectfully returned to Captain Keller, who is requested to state what dimensions of channel he thinks worthy of maintenance by the United States.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

U. S. ENGINEER OFFICE,
*Grand Rapids, Mich., November 11, 1902.*

Respectfully returned to Lieutenant-Colonel Ernst.

The intention of Congress in calling for an estimate of the cost of maintaining piers and channel is believed to be the ascertainment of the cost of maintaining the structures and the channel in a condition as good as that in which they were found to be at the time of the survey. Accordingly, the channel which it is proposed to maintain by means of dredging, the estimate of the cost of which is contained in paragraph 11 of the accompanying report, is a channel whose minimum depth shall be that which existed at the time of the survey and whose width shall be the least width practicable for the class of vessels which have been accustomed to use this harbor.

Such a channel would therefore be of a minimum available depth of 12 feet, referred to the zero of the engineer gauge, and its width should be not less than 50 feet. To afford this depth of 12 feet by means of dredging requires, in accordance with the usual practice of this district, dredging to a depth of 14 feet below the zero of the gauge. Based upon these dimensions, the above-mentioned estimate of the annual cost of dredging has been prepared.

CHARLES KELLER,
*Captain, Corps of Engineers.*

[Third indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, November 12, 1902.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that Arcadia Harbor is for the present worthy of being maintained by dredging to the extent stated in the second indorsement.

O. H. ERNST,
*Lieut. Col. of Engineers,*
*Division Engineer, Northwest Division.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*November 22, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Fifth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS.
*Washington, D. C., April 15, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has given due consideration to the within report of the district officer, the indorsements thereon, and several communications from interested parties.

The commerce of Arcadia Harbor, Michigan, is limited in amount and pertains largely to the business of a single corporation. Nevertheless, some general use of the harbor is made, and there is prospect of an increase and a change of character in the commerce of the port, owing to the rapid development of the tributary country.

Concurring with the district officer and the division engineer, the Board is of opinion that the circumstances of the large private expenditure already made in the construction of this harbor, and the reasonable prospect of increase of commerce, render it advisable that the United States maintain the existing depth and a practicable width of channel by means of dredging, at an expense of $3,000 annually, for a limited period of five years. At the end of this period it may readily be determined whether conditions will justify further work. Under present circumstances work on the piers is not deemed advisable.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

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### REPORT OF MR. C. W. H. SMITH, JUNIOR ENGINEER.

UNITED STATES ENGINEER OFFICE,
*Grand Rapids, Mich., October 21, 1902.*

CAPTAIN: I have the honor to submit the following report upon a survey of Arcadia Harbor, Michigan, made in accordance with your instructions "to submit an estimate of cost of maintaining piers and channel." The survey was made September 18-26, 1902, and a map of the harbor is submitted herewith.

Arcadia is an unincorporated village of about 400 inhabitants, situated in the S. W. ¼ of section 10 of the northwest township of Manistee County. It is at the north end of Bar Lake, which is about 18 miles north of Manistee Harbor, 9 miles north of Portage Lake Harbor, and 10 miles south of Frankfort Harbor.

At the present time the chief industries are a sawmill and dimension-stock factory with 58 employees, a veneer and basket factory with 65 employees, and a planing and feed mill combined. There are three general stores, and another building for the same purpose under construction, two blacksmith shops, two hotels, a cabinet shop, implement store, hardware store, drug store, meat market, and livery stable. The sawmill is operated the year round with the exception of about one month in the fall, when it is shut down for repairs, and has a daily capacity of about 38,000 feet B. M. of hard wood, or 80,000 feet B. M. of hemlock timber.

The sawmill and dimension-stock factory, veneer and basket factory, the larger of the three general stores, and a blacksmith shop are all owned and operated by the Henry Starke Land and Lumber Company.

Interior communication is afforded by the Arcadia and Betsey River Railway, 21 miles in length, running approximately midway between the Ann Arbor Railroad, about 10 miles to the north, and the Manistee and Northeastern Railroad, about the same distance to the south. At Henry, 17 miles from Arcadia, it connects with the Pere Marquette Railroad, and at Copemish, the eastern terminus, with the Ann Arbor and the Manistee and Northeastern railroads. This road was first built as a narrow-gauge logging road, but in 1895 it was widened to standard gauge. Two trains are run each way daily, one a mixed and the other a logging train. The railway, although a separate corporation, is owned and operated by the stockholders of the Henry Starke Land and Lumber Company. The country adjacent to the railway is largely covered with hard-wood forest. As soon, however, as the timber along the line in the northern part of Pleasanton Township is cut, which is looked for in the near future, it is the intention of the owners to change the alignment of the road so as to pass through the southern portion of the said township, thus shortening the line some 3 or 4 miles and offering rail communication with the village of Bearlake, which has a population of about 500 and is situated on the southeast shore of Bear Lake, in sections 4 and 5 of Bear Lake Township.

Bearlake is in touch with a good farming country, and its business greatly exceeds that of Arcadia, although it has no railroad connections except a narrow-gauge logging road (the Bear Lake and Eastern Railroad) running west from the village to a bridge pier at Pierport on Lake Michigan, 3¾ miles south of Arcadia Harbor. A great part of the produce of the surrounding country is shipped out over this road and thence by boat to Manistee or Frankfort. The bulk of freight received, however, comes by rail to Chief, a station on the Manistee and Northeastern Railroad, and is hauled from this point by team, a distance of about 7 miles. This is preferred to having the freight sent to Onekama, which is 2 miles nearer, on account of the bad roads and high sandy hills just north of that village. The Bear Lake and Eastern Railroad is to be taken up this fall and the bridge pier abandoned.

There are at present three regular boats running to Arcadia. One is a steam barge, the *Arcadia*, 119 feet long and drawing 11.5 feet loaded, which is owned by the Henry Starke Land and Lumber Company and used by them to carry their lumber to western markets. The others are small steamers, the *John D. Dewar*, 72 feet long, and the *Liberty*, 97 feet long, which run along the shore between Frankfort and Manistee, stopping at Arcadia twice each day.

Bar Lake is a body of water about 4,800 feet long, north and south, and with an extreme width of about 3,400 feet in the southern part. From the north end about 3,000 feet of the length of the lake is from 300 to 750 feet wide, with depths of from 20 to 35 feet, and with the 15-foot curve following very near the shore line. This part of the lake is parallel to the shore line of Lake Michigan and separated from it by a narrow strip of land from 300 to 750 feet wide. The village is situated at the north end of this narrow, deep portion of the lake. The larger, southern portion has depths of 15 to 18 feet in its western half and shoals off into a marsh at the east end, where it receives its only stream, Bar Creek. This lake is given on the Lake Michigan coast chart No. 9, as "N. Bar Lake." All the dock front and shore line, except the end of one street in the village, and the larger portion of the land along the south shore line, are owned by the Henry Starke Land and Lumber Company, the Arcadia and Betsey River Railway Company, or the individual members of both corporations. While the public dock at the foot of Pine street is only 66 feet long, the people have secured a right for boats of any length to lie at the dock.

The original, natural channel from Bar Lake to Lake Michigan was about 1,000 feet south of the north end of the lake. This channel was at times entirely closed by drifting sand, and when scoured out by floods was available only for rowboats and small fish boats.

The village of Arcadia was founded in 1880 by Henry Starke, of Milwaukee, Wis. He had acquired some 1,000 acres of hard-wood timber lands in the vicinity, and began to develop his property by erecting a sawmill, other buildings, and a bridge pier with a railway track extending into Lake Michigan about 1,000 feet on the line of what is now known as Lake street. Additional improvements were added as his business prospered, and Arcadia opened up a market for the products of the surrounding country. This bridge pier was in use from 1881 to 1893, inclusive, for shipping lumber, wood, bark, farm products, etc. For Mr. Starke's business alone this pier would have been fully sufficient for all time; but in 1892 he decided to take advantage of the opportunity offered for a harbor and proceeded to dig a channel from Bar Lake to Lake Michigan, completing it in 1893, with a depth of about 10 feet, and since the harbor has been open to all boats without any charge. This new channel is about 3,700 feet from the north end and 1,100 feet from the south end of the lake.

At the present time the north pier is 1,084 feet long and projects 645 feet beyond the shore line. The south pier is 1,339 feet long and projects 514 feet beyond the shore line. The north shore has advanced about 125 feet and the south shore about 230 feet since 1894. The south pier projects about 320 feet farther west than the north pier. The available depth between piers is 11.5 to 12 feet. The width between the piers at the inner end is 163 feet and at the outer end of the north pier 200 feet.

In the following description of the pier work all elevations are referred to zero of the harbor gauge.

### NORTH PIER.

From station 0, at the inner end, to station 3 + 00 the work consists of a single row of front and rear piles approximately 16 feet apart and filled in with slabs to an elevation of about − 0.5 foot, and from station 1 + 20 to station 3 + 00 the slabs are covered with from 1 to 2 feet of stone. The rear piles are 24 feet long, driven 8 feet to 10 feet centers, without wale or tie rods, to the front row, the mean elevation of the tops being about + 2.5 feet.

From station 3 + 00 to station 4 + 57 the front row of piles continues the same, while the structure in the rear consists of slab cribs 20 feet in width by about 8 feet deep, with a 2-foot timber superstructure 14 feet wide, the elevation of the top of this superstructure being about + 1.5 feet, and filled with slabs, sand, and stone. The channel face of these cribs is about 6 feet in rear of the front piles, while the channel wall of the superstructure is about 9 feet to the rear, the intervening space being filled with logs, slabs, and stone. This filling also extends as far west as station 4 + 80, as shown on the map. At station 4 + 57 is a row of nine guard piles at right angles to the axis of the pier, which mark the end of one season's work.

From station 4+57 to station 10+84.2 the work consists of a substructure of slab cribs and a timber superstructure protected on both the channel and lake side by a row of close piling except at the outer end where the piles have been carried away by storms and ice. These slab cribs are 22 to 24 feet wide and 30 to 80 feet long, the depth depending upon the soundings where the crib was to be sunk, which varied from 8 to 12 feet, and originally the top of the cribs was at the water surface.

The cribs were built up from two horizontal and parallel sills, 15 feet center to center, the sills being 8 by 12 inches (made of 4 by 12 inch plank), with horizontal 4 by 12 inch cross planks and 1 inch vertical tie-rods every 8 feet. The courses of slabs were cross laid and each course spiked along the edges of the crib. The tie-rods were of sufficient length to pass from the bottom of the sill to the top of the crib and through the first course of the superstructure, where they were secured with washer and nut. The superstructure was then built up three to four courses, approximately 16 feet wide; out to out, leaving the slab crib to project from 3 to 4 feet on each side. A single cross-tie was dovetailed into the side walls at intervals of about every 9 feet, while the end walls were built up solid. Each course of the side walls was driftbolted at approximately 5-foot intervals, the bolts in the second course being 24 inches long and in the succeeding courses 34 inches long. The crib when completed was towed to its proper place, and with a side in touch with the rear piles, which had been previously driven, was sunk on a sand foundation by filling the superstructure with stone. The front piles were then driven in close proximity to the channel face of the crib.

As stated previously when sinking the cribs the top of the slabs was approximately at the water surface, since, however, these cribs have settled and at present the elevation of the top of the slabs at station 4+60 is about −0.7 foot, thence sloping gradually to about −11 feet at the outer end. As the cribs settled from year to year the superstructure was built up and more stone added. At present the elevation of the superstructure varies from +2.3 to +4.4 feet, the mean being about +3.8 feet, while the elevation of the stone filling varies between station 4+57 and station 10+05 from +1 to +2 feet, the mean being about +1.7 feet. West of station 10+05 the superstructure is decked with 2-inch plank for its full width and filled to the top with stone. A 3-foot walk of 2-inch plank extends along the center of the superstructure from station 4+62 to 7+16. The front piles are, from station 0 to 5+97, about 24 feet long in the work, driven at about 4.2 feet centers, capped with a 4 by 12 inch plank as far west as station 5+70, and sheeted on the channel face with 3-inch plank from the top to the wale from station 0+13 to station 5+97. A 4 by 12 inch front wale, at about the water surface, extends from station 0+13 to station 5+81; and along the rear face of the piles, at the same elevation, is another wale 3 by 12 inches, extending from 0+19 to 5+42. Above this rear wale the piles are sheeted from station 1+97 to 5+42 in the same manner as the channel face. The cap, wales, and sheeting are all secured by spikes.

From station 0+43 to 1+54, station 1+97 to 2+04, and station 2+35 to 4+76 there is single sheet piling of 3 by 12 inch by 14 foot plank, spiked at the lower rear wale to the rear face of the pile cap. The elevation of the top of the cap plank varies from +2.2 feet at station 0 to +3.5 feet at station 5+97, the mean being +2.6 feet. The front piles from station 5+97 to the outer end at station 10+47 are driven about 1.3 feet centers, but the continuity is broken by four intervals amounting in all to 44 linear feet. The rear piles, commencing at station 4+50, are driven 3.7 feet centers as far as station 5+90, with the exception of a 11-foot gap west of station 4+68, thence at 1.3 feet centers to the outer end at station 10+41. The front piles west of station 5+97 and the rear piles are not connected with each other or to the pier proper by means of wales, ties, or otherwise; the tops are not cut off, the mean elevation being +3.9 feet for the front row and +4.5 feet for the rear row; the distance between the two rows varies from 30 to 33 feet, out and out. These piles are said to have varied in length from 26 to 32 feet in the front row and from 26 to 30 feet in the rear row. At the inner end of this pier, making an angle of about 100 degrees with the channel face, is a 100-foot wing, consisting solely of 11 round piles spaced equally distant.

### SOUTH PIER.

Between station 0 and 3+00, including the wing pier 97 feet long (making an angle of about 70 degrees with the channel face), the work is of the same construction as the north pier between stations 0 and 3+00, except that the wing pier is about 10 feet wide and the pier proper approximately 14.5 feet wide. Also, east of station 2+07, and in the wing pier, the work is strengthened by means of 1-inch tie-rods from the front wale to the rear piles. In the wing and the first 100 feet of the pier proper the elevation of the filling is about zero of gauge. From station 1+00 to station 3+00 the slabs are covered with sand and a small quantity of stone to the mean elevation of about +2 feet. Between station 2+00 and 2+25 there is a dredge dump, the top of which is about 4 feet above the top of the front piles. Between station 3+00 and station 5+36 the construction is the same as that of the north pier between stations 3+00 and 4+57, except for the two-course superstructure on top of the slab cribs. Here the top of the slabs is about 1 foot below the top of the front piles, and the space (3 to 8 feet) between the slabs and the front piles is filled with logs, edgings, and stone to an elevation of about +1.2 feet. This filling also extends as far west as station 5+73, as shown on the map.

The crib work with superstructure commencing at station 5+36 and extending to the outer end (station 13+37.8) is of the same construction as noted in connection with the north pier, except that in the outer stretch west of the row of piling at right angles to the axis of the pier (station 10+18) the cribs vary from 100 to 112 feet in length. These cribs have also settled considerably since first constructed, and at present the elevation of the top of the slabs is about —1.7 feet at the inner end and —14.7 feet at the outer end. The elevation of the top of the superstructure varies from +1.8 to +4.3 feet, the mean being about +3.3 feet. The superstructure west of station 10+18 is well filled with stone, and east of this point the elevation varies from +0.5 to +2.3 feet, with a mean of about +1.2 feet. West of station 12+12 the superstructure is decked for its full width, and east of this point a 3-foot walk extends as far as station 11+26. The front piles from station 0 to station 6+69 are driven about 4.2 feet centers, from station 6+69 to station 8+86, 1.4 feet centers, and from this last station to the outer end, 1.1 feet centers, except for a gap from station 8+86 to station 9+30, and a stretch from station 9+40 to station 13+09, containing 9 piles only.

The rear piles, commencing at station 5+35, are driven approximately 4.3 feet centers as far as station 6+79, thence to the outer end with 1.5 feet centers except for an interval of 13 feet west of station 12+85. The guard piles at the outer end are bound together near the top with a 4 by 12 inch plank along either face secured by screw bolts, otherwise the relation of the rear piles, and front piles west of station 8+10, in regard to themselves and the pier proper, length in the work and elevation of the top, is the same as that for the corresponding portion of the north pier. The distance between the two rows, however, varies from 25.5 to 31 feet. In the construction relative to the front piles from station 0 to 8+10, and those in the wing pier, it is the same as for the north pier between station 0 and 5+97, the cap extending as far west as station 8+10, the sheeting on the channel face to station 4+45, the wales to station 6+47, the sheet piles to station 2+93, and the sheeting on the rear face from station 2+93 to 5+75. The elevation of the top of the cap varies from +2.8 feet at station 0 to +4 feet at station 7+00, the mean being +3.3 feet.

The 12 by 12-inch timber used in the superstructure is entirely of hemlock, as is also the planking for all purposes, except those for the channel face wales, which are of rock elm and beech. About 80 per cent of the round piles are maple and beech, the remainder being hemlock and rock elm. That portion of the north pier from station 0 to station 4+57 and the south pier from station 0 to station 5+36 is in need of immediate repairs. From station 5+57 to station 7+86, north pier, and from station 5+36 to station 8+90, south pier, the superstructure will still be serviceable for about two years. From the last-named stations to the outer ends the piers are in fair condition and will not need rebuilding for about four years. All the maple and beech piles are in poor condition above the water level.

The amount expended on this work for pier construction and for dredging is shown by the following table, furnished by Mr. Charles J. Starke, president of the company:

*Amount expended on harbor improvements at Arcadia, Mich., by the Henry Starke Land and Lumber Company.*

| Calendar year. | Pier construction. | Dredging. | Total. |
|---|---|---|---|
| 1892 and 1893 | $10,138.62 | $11,709.93 | $21,848.55 |
| 1894 | 4,870.48 | 9,143.46 | 14,013.94 |
| 1895 | 4,310.67 | None. | 4,310.67 |
| 1896 | 3,442.71 | 2,513.67 | 5,956.38 |
| 1897 | 2,882.32 | 630.47 | 3,512.79 |
| 1898 | None. | None. | None. |
| 1899 | None. | 2,457.45 | 2,457.45 |
| 1900 | 163.84 | 1,926.12 | 2,089.96 |
| 1901 | None. | None. | None. |
| 1902 | None. | 1,797.51 | 1,797.51 |
| Total | 25,808.64 | 30,178.61 | 55,987.25 |

The number of tons of various articles shipped and received and the entrances and clearances of vessels during the past eight years are shown by the following table furnished by Mr. Starke:

### *Shipments to and from Arcadia Harbor.*

#### ARTICLES SHIPPED.

| Year. | Lumber. | Wood. | Bark. | Machinery, rails, etc. | Cedar posts and ties. | Merchandise. | Total. |
|---|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1894 | 12,415 | 7,437 | 1,385 | .......... | .......... | .......... | 21,237 |
| 1895 | 10,703 | 4,893 | 1,926 | .......... | 125 | 93 | 17,740 |
| 1896 | 15,801 | 4,845 | 2,020 | 320 | .......... | 38 | 23,024 |
| 1897 | 12,354 | 6,144 | 3,752 | .......... | 300 | 20 | 22,570 |
| 1898 | 16,215 | 3,955 | 3,532 | .......... | .......... | 132 | 23,834 |
| 1899 | 18,211 | 5,870 | 3,738 | .......... | .......... | 410 | 28,229 |
| 1900 | 20,285 | 5,637 | 3,047 | .......... | .......... | 674 | 29,643 |
| 1901 | 16,673 | 4,090 | 2,678 | .......... | .......... | 156 | 23,597 |

#### ARTICLES RECEIVED.

| Year. | Machinery, rails, etc. | Stone. | Merchandise. | Hay. | Total. |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1894 | 928 | 1,590 | 816 | .......... | 3,334 |
| 1895 | 1,030 | 1,185 | 406 | .......... | 2,621 |
| 1896 | .......... | 1,100 | 288 | 55 | 1,443 |
| 1897 | .......... | 1,840 | 177 | .......... | 2,017 |
| 1898 | .......... | .......... | 632 | .......... | 632 |
| 1899 | .......... | .......... | 657 | .......... | 657 |
| 1900 | .......... | .......... | 758 | .......... | 758 |
| 1901 | .......... | .......... | 524 | .......... | 524 |

#### ENTRANCES AND CLEARANCES.

| Calendar year. | Vessels entered. | | Vessels cleared. | |
|---|---|---|---|---|
| | Number. | Tons. | Number. | Tons. |
| 1894 | 507 | 36,356 | 506 | 36,120 |
| 1895 | 408 | 29,146 | 408 | 29,146 |
| 1896 | 504 | 33,223 | 504 | 33,223 |
| 1897 | 457 | 32,646 | 457 | 32,646 |
| 1898 | 460 | 31,993 | 459 | 31,757 |
| 1899 | 491 | 32,517 | 490 | 32,287 |
| 1900 | 514 | 36,795 | 514 | 36,795 |
| 1901 | 515 | 36,353 | 515 | 36,353 |

The above report practically includes the shipments made by Mr. Starke's company; except in the entrances and clearances, the shore boats are included. It will be noticed that the amount of the tons of merchandise shipped and received has decreased, but it is claimed that this is not a fact when taking into consideration that the amounts reported have been carried by the steamer *Arcadia* alone, and since 1900 the shore boats have been getting more of this traffic. It is impossible at this time to get an accurate statement as to the amount of freight carried by the two shore boats.

The following is a list of vessels using this port since 1896, of which a record was kept, not including the regular steamers *Arcadia*, *John D. Dewar*, and *Liberty*:

*1896.*—Steamer *Loretta* loaded rails for Buffalo; schooner *Evaline* made 1 trip; schooner *Ellenwood* made 1 trip.

*1897.*—Schooner *E. T. Judd* loaded 500,000 feet lumber for Buffalo.

*1898.*—No record.

*1899.*—Steamer *Myrtie Ross* made 22 round trips; schooner *Libbie Carter*, 7 round trips; schooner *Williams*, 4 round trips; schooner *Narragansett*, 1 trip; schooner *Rambler*, 1 trip; schooner *Leo*, 3 round trips; schooner *Vermont*, 4 round trips; schooner *Canters*, 1 trip; steamer *Pewaukee*, 1 trip; steamer *W. J. Carter*, 1 trip; schooner *Mickelson*, 4 round trips; schooner *Bell*, 1 trip; schooner *James H. Hall*, 2 round trips; schooner *J. M. Mason*, 2 round trips; schooner *Winnie Wing*, 1 trip; schooner *Packard*, 1 trip.

*1900.*—Schooner *Vermont* made 4 round trips; schooner *Jesse Martin*, 2 round trips; schooner *Libbie Carter*, 5 round trips; schooner *James H. Hall*, 5 round trips; schooner *Grover*, 2 round trips.

*1901.*—Schooner *James H. Hall* made 11 round trips; schooner *Vermont*, 1 trip; steamer *Burnham*, 1 trip; schooner *Jesse Martin*, 1 trip; schooner *Lettie May*, 2 round trips; schooner *Avery*, 2 round trips.

*1902.*—Schooner *James H. Hall* made 12 round trips; schooner *Lettie May*, 1 trip; steamer *Burnham*, 2 round trips; schooner *Jesse Martin*, 2 round trips; schooner *Barnes*, 1 trip; schooner *Condor*, 1 trip.

Aside from the above, a number of small hookers trade here every year during the fruit season.

Vessels of which no record was kept have also used the harbor for refuge.

The country tributary to Arcadia Harbor may be said to comprise all of Arcadia and Pleasanton townships and portions of the townships of Blaine, Joyfield, Springdale, Bear Lake, and Onekama. According to the census of 1900 the population of these townships is as follows: Arcadia, 881; Pleasanton, 659; Blaine, 498; Joyfield, 328; Springdale, 558; Bear Lake, 1,428; Onekama, 920. The rural mail route from Arcadia post-office is 24¾ miles long, and is said to accommodate 447 persons, while a fourth-class post-office still in existence on the same route accommodates an additional 250 persons.

The following table, taken from the farm statistics of 1900–1901, gives the acreage of improved and unimproved lands in the above-mentioned townships:

| Counties and townships. | Improved. | Unimproved. | Total. | Number of farms. | Average acres per farm. |
|---|---|---|---|---|---|
| Benzie County: | | | | | |
| Blaine Township | 3,622 | 3,338 | 6,960 | 91 | 77 |
| Joyfield Township | 2,836 | 3,501 | 6,337 | 62 | 102 |
| Manistee County: | | | | | |
| Arcadia Township | 3,814 | 3,079 | 6,893 | 91 | 76 |
| Pleasanton Township | 6,031 | 4,927 | 10,958 | 119 | 92 |
| Springdale Township | 912 | 1,771 | 2,683 | 38 | 71 |
| Onekama Township | 3,536 | 1,919 | 5,455 | 83 | 66 |
| Bear Lake Township | 8,536 | 6,413 | 14,959 | 162 | 92 |

The soil in the country adjacent to Arcadia is well adapted to farming purposes. The principal crop thus far has been grain, potatoes, corn, and hay, and, while the fruit industry is in its infancy, large amounts of peaches and apples are shipped out annually. Stock raising is also engaged in to some extent.

In regard to the lumbering interest, it is estimated that if the present mill at Arcadia were to confine itself to cutting simply its own timber and making lumber out of it exclusively it would complete the cut in about six years. However, with the timber tributary to it owned by other parties, and which it is claimed can be relied upon, the cut of the mill, with the basket and veneer factory being operated at the same time, will extend over a period of about ten years.

The following table, furnished by Mr. Starke, gives the traffic movement in tons on the Arcadia and Betsey River Railway of the freight originating on its own line between Arcadia and Copemish during the last two years:

| Commodity. | 1900. | 1901. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Grain | 198 | 278 |
| Flour | ....... | 1 |
| Hay | 161 | 218 |
| Fruit and vegetables | 774 | 455 |
| Potatoes | 1,261 | 1,561 |
| Live stock | 25 | 51 |
| Dressed meat | ....... | 4 |
| Other packing-house products | 12 | ....... |
| Poultry, game, and fish | 4 | ....... |
| Hides and leather | 2 | 2 |
| Castings and machinery | 155 | 15 |
| Household goods and furniture | 17 | 21 |
| Other merchandise, etc | 87 | 36 |
| Total | 2,641 | 2,632 |
| Forest products (logs, wood, lumber, and bark) | 27,318 | 23,341 |
| Total tonnage | 29,959 | 25,973 |

[illegible]

[illegible]

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## [illegible]

## [illegible] HARBOR, MICHIGAN, [illegible] PINE LAKE.

[illegible]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, [illegible], 1902.

SIR: I have the honor to submit herewith a report, dated October 3, 1902, by Capt. Charles Keller, Corps of Engineers, on preliminary examination of Charlevoix Harbor, Michigan, with a view to obtaining a channel [illegible] feet in depth from Lake Michigan to Pine Lake, ordered by the river and harbor act of June 13, 1902.

Under operations heretofore carried on by the United States for the improvement of this locality a channel depth of 17 feet has already been secured, and Captain Keller states that the present facilities for navigation seem ample, and that nothing more than thorough maintenance appears to be called for.

In his opinion, concurred in by the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers, and by the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act, the extension of the project for improvement of this locality in the manner indicated by the act is not considered worthy of being undertaken by the United States. I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF CAPT. CHARLES KELLER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Grand Rapids., Mich., October 3, 1902.*

GENERAL: I have the honor to submit the following report upon a preliminary examination of Charlevoix Harbor, Michigan, "with a view to obtaining a channel 18 feet in depth from Lake Michigan to Pine Lake."

This examination and report are required by the provisions of section 14 of the river and harbor act of June 13, 1902, and the duty was assigned to my charge by letter of the Chief of Engineers dated June 23, 1902.

Charlevoix Harbor lies at the mouth of Pine River, on the eastern shore of Lake Michigan, about 35 miles from the western entrance of the Straits of Mackinac and upon the peninsula between Grand and Little Traverse bays. Pine River gives access through its lower portion, the so-called "Lower channel," to Round Lake, which is really the harbor proper of the town of Charlevoix, and thence through the upper channel to Pine Lake. Round Lake is about one-half mile in diameter and has depths of over 40 feet. Pine Lake is about 15 miles long and 1 to 2 miles wide. Its maximum depths exceed 60 feet. The main channel in Pine Lake extends to the town of Boyne. About 6 miles from the western end of the lake an arm of Pine Lake (called the South Arm) extends southward 8 miles to the villages of East Jordan and South Arm.

Charlevoix Harbor has been under improvement by the United States since 1878, when actual operations were begun under an appropriation made in 1876. The first appropriation for the upper channel was made in 1882 and actual work begun in 1885.

Up to the time of the enactment of the current river and harbor act the project for this harbor, as finally modified in 1885, proposed, at an estimated cost of $186,000, the creation of a 12-foot channel from Lake Michigan to Round Lake between piers and revetments 100 to 150 feet apart, and from Round Lake to Pine Lake between revetments 83 feet apart.

To June 30, 1902, there had been expended upon this project the sum of $154,368.81, with the result that a channel of at least the required depth throughout had been created and maintained, although an extension of 200 feet remained to be added to the south pier to complete the project. Upon June 30, 1902, the maximum draft which could be carried through the lower channel to Round Lake was 16.3 feet, while a depth of 15 feet existed in the upper channel. These depths are referred to the zero of the harbor gauge which is at mean lake level for the period 1861 to 1875, reference 581.28 above mean tide at New York City. At the date of this report the actual lake stage is a foot below this zero, and during the late fall and early winter, while navigation is still open, the gauge readings are apt to fall somewhat lower than −2 feet for the monthly mean, while individual readings are somewhat lower than the figures quoted.

The river and harbor act of June 13, 1902, contained the following provision:

> Improving harbor at Charlevoix and entrance to Pine Lake, Michigan: Continuing improvement, $20,000, to be first expended in obtaining a uniform depth of channel from Lake Michigan to Pine Lake.

This provision, in effect, changed the project at this harbor so that the depth to be obtained from lake to lake is now 16.3 feet, the controlling depth of the lower channel shown by the survey of June 17–19, 1902, a print[a] of which is herewith, and to secure this depth dredging in the upper channel became necessary.

Under a project dated June 25 and approved July 7, 1902, for the expenditure of the funds appropriated by the act of June 13, 1902, in compliance with the requirements of the above-quoted condition, an emergency contract was entered into with Samuel O. Dixon, of Milwaukee, Wis., for the dredging in the upper channel necessary to secure the necessary channel of uniform depth from lake to lake. The total quantity dredged amounted to 30,370 cubic yards, and as a result the depth in the upper channel is now, as shown upon the print, not less than 17 feet, or 0.7 foot deeper than the controlling depth of the lower channel.

At present, therefore, the harbor at Charlevoix is in the following condition: A depth of not less than 16.3 feet is found in the lower channel and this occurs upon but one range opposite station 6, the channel soundings upon the adjoining ranges being well over 17 feet. The piers and revetments protecting this channel are in good condition, requiring only the customary maintenance with the exception of the north revetment which, from station 0 to station 9+44 is a plank beam, built at various times between 1882 and 1887 and now in ruins west of the angle near station 2+40. Only the portion of this revetment west of station 4+50 is now maintained by the United States, that east of this point being in use by private parties as a coal dock and for various other purposes. In the upper channel the available depth is not less than 17 feet but the banks are sand and the existing revetments, consisting of pile work built in 1885, are not sand tight and for the preservation of the depth require extensive rebuilding, part of which is, however, included in the above-mentioned project of June 25, 1902, which contemplates rebuilding the entire north revetment of the upper channel at a cost of $3,000. In effect, therefore, with the exception of a few lumps in the lower channel near and west of station 6, a through 17-foot channel exists, which may readily be rendered permanent by the customary operations of maintenance.

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[a] Not printed.

The commerce tributary to this harbor consists of the summer passenger business and of freight, of which probably more than 90 per cent is outward-bound lumber and forest products.

Commercial statistics, as obtained at this harbor and recorded in successive Annual Reports of the Chief of Engineers, have never been complete. With reference to the passenger traffic, the most that is definitely known is that at present and for several years past three large steamers have made during the three summer months regularly scheduled trips to this harbor from Chicago, these trips varying for each steamer from two to three per week, and it is known that this passenger business is relatively large and increasing.

Freight statistics have been unsatisfactory, because most of the traffic originating upon Pine Lake is known not to have been reported by the deputy collector of customs at Charlevoix, for the reason that vessels in this trade do not clear there. As an illustration of the defective nature of these freight statistics may be cited the report of shipments from Charlevoix for the calendar year 1901, as given in the Annual Report for 1902. The total there given is 169,057 tons, whereas it is reliably known that the shipments from the head of Pine Lake amounted to over 275,000 tons.

For the passenger traffic and that part of the freight traffic directly tributary to the harbor of Charlevoix proper, the depth at present existing in the lower channel is believed to be adequate. The demand for greater depth, as far as can be ascertained, seems to have originated with the lumber interests at the head of Pine Lake, where the villages of Boyne, South Arm, and East Jordan are now the scene of a considerable and growing traffic in this commodity. There are three large sawmills, a shingle mill, lath mill, and two planing mills at Boyne, while another sawmill and a stave and heading mill are to be constructed. In addition, there are a tannery and a chemical plant, and it is reported that a blast furnace is to be erected. The shipments of lumber and forest products from Boyne and near-by points during the calendar year 1901 aggregated 160,026 tons of 2,000 pounds, as shown in the letters of Messrs. G. Von Platen and William H. White & Co., hereto appended. From East Jordan and South Arm the shipments of sawed lumber and of forest products aggregated 117,371 tons, as shown in the letters of the South Arm Lumber Company, the East Jordan Lumber Company, and in the statement of Mr. C. L. Lorraine, of East Jordan, all of which are appended. The shipments from Boyne, it is stated, will be practically doubled in the near future, while those from South Arm will hereafter be increased by 40,000 tons annually, due to shipments of white pine to be made by the estate of David Ward, as shown in the letter herewith.

In all, therefore, shipments from the head of Pine Lake should in the near future aggregate from 350,000 to 450,000 tons, with a probable duration, at this rate, of twenty to thirty years. To this should be added from 75,000 to 125,000 tons originating at and near Charlevoix. The traffic is, therefore, now of great value and will grow increasingly valuable.

It is true, however, that complaints made by the Pine Lake interests related exclusively to the upper channel, and were made at a time when its depth was uncertain and insufficient, varying as it did from 14 to 15 feet below the gauge zero, these depths, as previously stated, being reduced by about 2 feet in the late fall and early spring. This condition has been remedied by the recent dredging, so that now the upper channel affords a depth of 17 feet for a width of 50 feet or more. With the removal of the small shoal in the lower channel at and west of station 6, which will take place early next year, the through depth will be 17 feet. The lower channel is practically self-maintaining, while the repair of the revetments of the upper channel should prevent much shoaling there.

The channel throughout will afford ample depth for the largest lumber carriers which are likely to be in use. A lumber barge of more than average size, carrying about 1,000,000 feet B. M., will draw from 13½ to 14½ feet, depending upon the kind of lumber carried. The present facilities for navigation, therefore, seem ample, and nothing more than thorough maintenance appears to be called for.

In view of the preceding facts, I have the honor to report that the improvement of Charlevoix Harbor, "with a view to obtaining a channel 18 feet in depth from Lake Michigan to Pine Lake," is not worthy of being undertaken by the United States.

Very respectfully, your obedient servant,

CHARLES KELLER,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., October 4, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army.

I concur in the opinion that a depth of 18 feet is in excess of the present requirements at Charlevoix Harbor, and that the improvement of the harbor to that extent is not advisable.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 13, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 1, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer, the indorsement of the division engineer thereon, and other data at hand.

The harbor at Charlevoix, Mich., has been under improvement by the United States to a depth of 12 feet. The river and harbor act of June 13, 1902, by its tenor, modifies the project to require a uniform depth in "Lower channel," between Lake Michigan and Round Lake (the latter constituting the harbor proper of Charlevoix), and "Upper channel," between Round Lake and Pine Lake. The sum appropriated has proved sufficient to create a depth of practically 17 feet at mean lake level from Pine Lake to Lake Michigan. This depth is believed by the Board to be sufficient for present and reasonably prospective commerce, and should be maintained.

The Board is of the opinion that it is not desirable for the United States to extend the project with a view to providing a depth of 18 feet at Charlevoix Harbor, Michigan, from Lake Michigan to Pine Lake, as contemplated in the act ordering the preliminary examination.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## APPENDIXES.

## [1.]

### LETTER OF MR. G. VON PLATEN.

Boyne, Mich., *September 3, 1902.*

My Dear Sir: Understand from W. H. White & Co. that you wish report of the tonnage shipped from our docks during the season of 1901. Taking the weights per M feet adopted by the railroads, we shipped last season by water, in ties, posts, wood, and lumber, 33,119 tons; and if anything this amount will increase for the next ten years. Besides the mills in this town, of which you will get a report, there has been shipped by the Maltby Lumber Company, of Boyne Falls, at least 15,000 tons, 6,000 tons by the A. J. Beardsley mills at Thumb Lake, and 4,000 tons by Guerin & Jubenville, at Hortons Bay. All these mills expect to ship, and will ship, in the future. It is absolutely necessary for us to get a deeper channel at Charlevoix between Pine Lake and Round Lake, as the light-draft boats are going out of commission as they become old and unseaworthy, and the carriers being built are all deep draft.

Truly yours,

G. Von Platen.

Capt. Chas. Keller.

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## [2.]

### LETTER OF MESSRS. W. H. WHITE & CO.

Boyne, Mich., *August 30, 1902.*

Dear Sir: In reply to your letter of August 21, as we have written you before, we appreciate the interest you have taken in getting us the channel through to the big lake at Charlevoix, and will do all we can to help maintain it. We have requested the prominent shippers around Pine Lake to send in a report to you of the average tonnage for each season of navigation, as nearly as they can estimate it. We gathered this information for the Department at Washington last winter, and as nearly as we can estimate the product shipped by William H. White & Co. for last season of navigation, and which will be about the same this year, was as follows:

| | Tons. |
|---|---|
| Hemlock lumber | 19,164 |
| Hard-wood lumber | 50,672 |
| Ties and posts | 1,942 |
| Hemlock slabs | 3,225 |
| Hard wood slabs | 23,815 |
| Shingles | 461 |
| Lath | 113 |
| Bark | 2,515 |
| Total | 101,907 |

This is about the average tonnage from White & Co.'s docks for a season. We have between 18,000 and 20,000 acres of virgin hardwood timber land from which we will cut the timber, maintaining this rate of product for about twenty years more. Mr. W. H. White, activê manager for White & Co., is also president and manager of the Boyne City Lumber Company, a corporation just formed, and which has purchased altogether about 18,000 acres of heavily timbered hardwood land, and they are about to erect a mill at Boyne for the manufacture of the lumber, and also the other products. This mill will cut approximately the same as White & Co., which will increase the tonnage by just about the same amount as that shipped by White & Co. Mr. G. Von Platen, of this village, will send you in his report direct. We will have Mr. W. S. Shaw, who is actively connected with the Boyne City Chemical Company, and who has an iron mine near Iron Mountain, and who is arranging for a blast furnace to be built at Boyne, the ore for which will come in by boat and the principal part of the pig iron go out by boat, write you in regard to the probable tonnage of the iron industry. From all these reports you will gather the fact that quite a large quantity of shipping is pointing toward Pine Lake, and that a good channel of proper depth from Pine Lake into Lake Michigan is a very important matter.

Trusting this information is what you desire and that you will get the reports in proper time from these other firms, and again thanking you for your active interest in the welfare of Pine Lake, we remain,

Respectfully,

W. H. White & Co.

Capt. Chas. Keller.

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[3.]

### LETTER OF THE SOUTH ARM LUMBER COMPANY.

South Arm, Mich., *September 8, 1902.*

Dear Sir: Below find statement of lumber, etc., shipped by us by water from this port during season of 1901.

| | Tons. |
|---|---|
| Hard-wood lumber | 9,173 |
| Hemlock lumber | 1,743 |
| Cedar shingles | 723 |
| Cedar ties | 975 |
| Cedar posts | 341 |
| Maple slabs | 4,907 |
| Total | 17,862 |

Yours, truly,

South Arm Lumber Co.
Per Whelan.

Capt. Charles Keller.

### [4.]

### LETTER OF THE EAST JORDAN LUMBER COMPANY.

East Jordan, Mich., *September 5, 1902.*

**Dear Sir:** W. H. White & Co., of Boyne, have asked us to furnish you with tonnage shipped by this company by water during the year 1901 in order that you have the necessary figures to complete your report.

Our shipments during the season of navigation for 1901 were as follows:

| | Tons. |
|---|---|
| Hard-wood lumber | 24,750 |
| Hemlock lumber | 23,005 |
| Slabs and edgings | 14,850 |
| Railroad ties | 1,344 |
| Paving or fencing posts | 240 |
| Shingles | 2,010 |
| Hemlock bark | 1,310 |
| Total | 67,509 |

Yours, very truly,

East Jordan Lumber Company,
Per Geo. G. Brown.

Capt. Charles Keller.

### [5.]

### STATEMENT SHOWING SHIPMENTS FROM PINE LAKE NOT OTHERWISE GIVEN.

[Furnished by Mr. C. L. Lorraine, of East Jordan, Mich.]

| | Tons. |
|---|---|
| Bush & Co.: | |
| Hardwood | 8,250 |
| Hemlock | 4,300 |
| Slabs | 5,400 |
| Bark | 1,500 |
| Wood | 900 |
| | 20,350 |
| W. L. French: | |
| Wood | 900 |
| Potatoes | 300 |
| | 1,200 |

| | Tons. |
|---|---|
| Cameron Bros.: | |
| Hardwood | 2,750 |
| Hemlock | 2,150 |
| Bark | 1,800 |
| Slabs | 2,700 |
| | 9,400 |
| J. Thompson, timber | 1,250 |

### [6.]

### LETTER FROM THE REPRESENTATIVE OF THE ESTATE OF MR. DAVID WARD.

Deward, Crawford County, Mich., *September 20, 1902.*

**Dear Sir:** We have received a letter from the East Jordan Lumber Company, East Jordan, Mich., asking us to forward to you the amount of tonnage shipped by us this year, stating you would like to have the figures in making up your report to Washington in regard to deepening the canal at Charlevoix. We will ship this year about 1,000,000 feet by boat, and every year hereafter it will probably run 25,000,000 feet to 30,000,000 feet. The reason for the small amount this year is that we finished our mill very late this season and did not have very much on hand when navigation opened. Hereafter we will saw the year round and will ship about 25,000,000 to 30,000,000 feet.

Hoping this information will be of some benefit to you in making up your report, we remain,

Yours, very truly,

Estate of David Ward,
Per Geo. K. Root.

Capt. Chas. Keller.

## M M 18.

## PRELIMINARY EXAMINATION AND SURVEY OF SOUTH HAVEN HARBOR, MICHIGAN.

[Printed in House Doc. No. 119, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith reports dated October 15, 1902, and January 10, 1903, by Capt. Charles Keller, Corps of Engineers, on preliminary examination and survey, respectively, of South Haven Harbor, Michigan, with a view to obtaining 18 feet depth of channel, authorized by the river and harbor act approved June 13, 1902. South Haven Harbor has been improved by the United States under a project having in view the creation of a 12-foot channel by the construction of piers and revetment at the mouth of Black River and by dredging. Captain Keller states that while facilities are admittedly inadequate, it is not believed that an 18-foot channel is either necessary or desirable. He is of the opinion that it is proper to provide a depth of channel sufficient for the accommodation of vessels now using the harbor, and that a depth of 16 feet in Black River and the channel between the piers will answer all the needs. In this opinion the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers, concurs.

Captain Keller submits in his report of survey a plan for such improvement by means of pier extension and dredging at an estimated cost of $279,370, and $10,000 annually for maintenance. He states, however, that it will be impossible to maintain a 16-foot channel unless efficient docks are built on both banks of the river, and in his opinion the improvement should not be begun until such docks are provided and the banks revetted by local interests; also that such property as may lie on the channelward side of the proposed dock lines should be deeded to the United States free of cost, and that no appropriation for the further improvement of this harbor should be made until the property has been acquired by the United States.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, in accordance with the provisions of sections 3 and 14 of the above-mentioned act, and I concur in the views of the Board, expressed in its report of March 26, 1903, as follows:

> It is the opinion of the Board that, prior to any further improvement of South Haven Harbor by the General Government, proper dock lines should be established and suitable bulkheads should be built along these lines by the riparian owners, and the property lying on the channel side of these dock lines should be deeded to the Government free of cost. The Board believes that, after these conditions have been complied with, the improvement of the harbor to a depth of 16 feet, as proposed by the district officer, is warranted by the present and reasonably prospective commerce, and that it will then be desirable for the United States to undertake the work.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

## PRELIMINARY EXAMINATION OF SOUTH HAVEN HARBOR, MICHIGAN.

United States Engineer Office,
*Grand Rapids, Mich., October 15, 1902.*

**General:** I have the honor to submit the following report upon a preliminary examination of South Haven Harbor, Michigan, "with a view to obtaining 18 feet depth of channel."

This examination and report are required by the provisions of section 14 of the river and harbor act of June 13, 1902, and the duty was assigned to my charge by letter of the Chief of Engineers dated June 23, 1902.

South Haven Harbor lies on the east shore of Lake Michigan, about 22 miles NNE. ⅜ E. of St. Joseph Harbor and 17½ miles south of Saugatuck Harbor, being at the mouth of Black River, a small stream which flows into Lake Michigan through a channel protected in part by piers and revetments.

This harbor has been under improvement by the United States since 1867, when there existed a channel 7 feet deep and 85 feet wide between slab piers built by private parties. The existing project for the improvement of this harbor is that of 1866, as modified in 1869, 1872, 1888, and provides for constructing piers and revetments at the mouth of Black River 166 to 173 feet apart, with the object of creating and maintaining a 12-foot channel, to be extended one-half mile up Black River to the Dyckman Street Highway Bridge by the necessary periodical dredging. Estimated cost of original project, as finally modified, $317,000.

To June 30, 1902, there had been expended at this harbor $299,965.59. As a result of this expenditure all original construction embraced by the approved project has been completed, and the desired 12-foot channel has been repeatedly dredged. Through the advance of the shore line a general shoaling near the ends of the piers has taken place, so that the dredged entrance channel is soon obliterated by the storms of early fall. The channel in the inner part of the harbor suffers greatly from the unprotected state of a large portion of the north bank, and some deterioration is probably also due to the sediment brought down by the spring floods which is deposited in the relatively deep portion of the river below the bridge. Maintenance by dredging and repair of structures has therefore consumed of the above total the sum of $112,732.76, or nearly 40 per cent.

The present condition of the harbor is shown in the accompanying plate,[a] which is a positive print from the tracing of the harbor survey of April 24-28, 1902, the red-shaded areas indicating the extent of the dredging executed May 19-30, 1902, under an allotment of $2,300 from the appropriation for emergencies in river and harbor works of the act of June 6, 1900. As seen from the plate, the length of the north pier and revetment is 1,793 feet, and of the south pier and revetment 1,782 feet. The north pier projects 870 feet and the south pier 685 feet beyond the shore line. About 200 feet beyond the ends of the piers there was a central shoal with a least depth of 11.9 feet, and between the piers in the usual steamboat channel the minimum depths varied from 8.3 to 13.9 feet, all depths being referred to the zero of the gauge, actual depths, as stated in the plate, being at the time 1.4 to 1.9 feet less. Mention is made of the depths in the "usual steamboat channel" because the channel between the piers has never been available for its full width, a channel 50 feet wide near the south pier being all that has ever been provided.

In the river above the piers the minimum channel depths in the customary channel varied from 8.8 to 12.5 feet referred to the gauge zero, actual depths being less to the extent hitherto stated. Dredging in this part of the harbor has been in the past limited to a single central cut 25 to 30 feet wide. East of station 10, east, the north bank is practically without revetment of any kind, so that the turning basin shown near stations 20 and 21 has been formed by the action of the propellers of boats while winding at the docks directly opposite.

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[a] Not printed.

The commerce tributary to this harbor is experiencing a healthy growth, as shown not only by the commercial statistics, but also by the outward and evident increase of prosperity in the city of South Haven and in the neighboring summer resorts. Until this year this commerce was derived almost exclusively from passenger business during the summer season and from freight consisting of the fruit raised in the surrounding country, practically all of the passenger business originating in Chicago, while, of course, the bulk of the freight originated at the other end of the line. At present only a single line of steamers is in service between South Haven and Chicago, this having been formed by a consolidation of the Williams Transportation Company and the Dunkley Company, which in 1901 competed for the business.

For the transaction of an extensive freight traffic, until this spring, the harbor of South Haven, owing to its poor rail connections, has been at a disadvantage. Early this spring, however, the Michigan Central Railroad Company improved its terminals and service at South Haven with a view to establishing, in connection with the Dunkley-Williams Company, a regular service to Milwaukee and the Northwest. As a result the actual freight tonnage shipped to and from this harbor has greatly increased during the present year. The detailed statistics are furnished in the paper herewith, prepared by Mr. R. W. Crary, third vice-president and auditor of the Dunkley-Williams Company, and for the sake of brevity are not repeated. The total freight has increased from 58,104 tons in the calendar year 1901 to 88,308 tons (partly estimated) in the year 1902, while the number of passengers will increase from 120,670 in 1901, to probably 150,000 in 1902. The growth shown, while not phenomenal, is evidence of increased use of facilities already existing, and it is probable that improved and more certain channel depths will lead to still greater expansion.

The commerce is a valuable one, the freight alone being valued at nearly $1,000,000, and there is no question that present inadequate facilities tend to increase the cost to the public of the business actually handled and serve to divert some traffic which under existing arrangements might properly come to South Haven. The largest vessel at present regularly in service at South Haven is the steamer *Puritan*, whose gross tonnage is 770, net tonnage 544, length 171.3, breadth 30.4, and depth 12.2 feet. The steamer *City of Kalamazoo* is very slightly smaller, and the *Glenn*, the third steamer regularly in use at this harbor, has not much over a third of the tonnage of the other two. Such vessels are too small to handle freight to the best advantage or to attract passenger travel, but in its present condition the harbor does not permit the use of larger boats.

While facilities are admittedly inadequate, it is not, however, believed that an 18-foot channel is either necessary or desirable, since a greater depth than is actually needed will serve simply to saddle upon the United States a useless charge for maintenance. Business of the character of that now and hereafter to be transacted at South Haven may be economically served by vessels of a gross tonnage of about 1,200 tons, with a net tonnage of perhaps 900 to 1,000 tons. Such a boat, if properly designed, may carry 1,200 to 1,500 tons of freight upon a draft not to exceed about 14 feet. Larger boats than this would probably be unprofitable, because full cargoes are not always to be had, and the passenger business offered would perhaps never overtax the capacity of a boat of this size. A boat of this tonnage would be about 200 feet long, 33 to 36 feet wide, and about 13.5 feet deep. That these figures are approximately correct is shown by a consideration of the dimensions of the steamers which for years past have been doing a business similar to that to be expected at South Haven. The leading dimensions in the case of five of these steamers are given in the following table, all of these being now in use from Muskegon and Grand Haven to Chicago and Milwaukee:

| Name. | Gross tonnage. | Net tonnage. | Length. | Breadth. | Depth. |
|---|---|---|---|---|---|
| | | | *Feet.* | *Feet.* | *Feet.* |
| Alice Stafford | 843 | 485 | 202.0 | 32.0 | 21.9 |
| Indiana | 1,177 | 961 | 201.0 | 35.4 | 14.3 |
| Iowa | 1,157 | 846 | 202.5 | 36.4 | 13.0 |
| Naomi | 1,181 | 1,020 | 203.9 | 35.1 | 11.7 |
| Nyack | 1,257 | 1,024 | 231.0 | 33.0 | 14.7 |

Of the boats in this table only the *Indiana* and the *Iowa* were expressly built for the service upon which they are now placed, and it is believed that their dimensions are satisfactory and should be reproduced in vessels for similar service. Such steamers when fully loaded should not have a draft in excess of 13.5 to 14 feet.

It is therefore proper to provide a depth of channel sufficient for the class of steamers just described. A depth of 16 feet in Black River and in the channel between the piers will answer all needs. At the ends of the piers it will be necessary to have a depth at least 2 feet greater in order to make the entrance possible of access during storms, but the increased depth immediately at the entrance has always, in the practice of this office, been assumed to be implied in any project which specifically provided for any given channel depth, this latter depth being held to refer to that portion of the channel where the effect of seas in diminishing the available depth was not to be expected.

Before, however, any additional depth may properly be created in Black River, it is desirable that the city of South Haven take the necessary steps to secure the provision of efficient revetments upon both banks. At present the south bank is fairly well protected, while the north bank is protected only west of station 10 E, and even in this portion the revetment is of poor design and is not continuous. Moreover, the channel is too narrow, the river being barely 100 feet wide from bank to bank at station 19 E, and the existing turning basin is not suitable for the winding of the larger vessels which it is proposed to use. To remedy these latter matters a dock line, in the past several times proposed and discussed without result by the property and navigation interests at this harbor, should be adopted, extending on the north bank from the west end of Smith's dock to the point marked "Station 21" at the turning basin. Property owners should be required to build efficient revetments upon this line, thus making the width from one dock to the other about 200 feet. Only after this has been done will it be feasible to create and maintain, with certainty and without undue cost, a 16-foot channel in the part of the harbor east of Station O.

In view of the foregoing, I have therefore the honor to report that the improvement of South Haven Harbor "with a view to obtaining 18 feet depth of channel" is not worthy of being undertaken by the United States, but that, after a proper dock line upon the north side has been adopted and efficient docks or revetments built, an improvement of this harbor to a depth of 16 feet is justified by the existing and prospective commerce.

Very respectfully, your obedient servant,

CHARLES KELLER,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., October 17, 1902.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that South Haven Harbor is worthy of improvement to a depth of 16 feet, and that a depth of 18 feet is in excess of present requirements.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*November 3, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 2, 1902.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of Captain Keller on the preliminary examination of South Haven Harbor, Michigan.

In the opinion of the Board the commerce involved is so large as to warrant a further improvement of the harbor to a depth of 16 feet, provided such improvement can be made at reasonable cost.

The Board, therefore, recommends that a survey be made, if sufficient data be not available, and that the cost of improving the harbor be estimated.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*December 8, 1902.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of South Haven Harbor, Michigan, authorized by the river and harbor act of June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality and estimate of cost of improvement as proposed be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,
*December 11, 1902.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*January 20, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 26, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has carefully considered the report referred to in the preceding indorsement.

The district officer expresses the opinion, concurred in by the division engineer, that the improvement of South Haven Harbor "with a view to obtaining 18 feet depth of channel" is not worthy of being undertaken by the United States, but that, after a proper dock line upon the north side has been adopted and efficient docks or revetments built, an improvement of this harbor to a depth of 16 feet, at an estimated cost of $279,370, is justified by existing and prospective commerce.

In this report the district officer states—

> The piers and revetments built by the United States have their inner end at the point marked "station O" upon the map. Inside this point, to the highway bridge, the operations of the United States have been confined to dredging for the creation and maintenance of the authorized depth of channel, and this has been rendered difficult by the fact that the river banks, originally low and swampy, have only recently been properly docked by the property owners upon the south side, while on the north there is no protection above station 10 E. * * * It will, however, be impossible to maintain a 16-foot channel unless efficient docks exist upon both banks, and it is believed that these docks should be built upon the lines shown so as to afford a channel of approximately 200 feet width. Such property as may lie upon the channelward side of the proposed harbor lines should be deeded to the United States free of all cost, and it seems proper that no appropriation for the further

improvement of this harbor be made until the above property has been acquired by the United States and properly constructed docks upon the lines shown have been built by the riparian owners. The adoption of the harbor lines shown will also permit the dredging of a larger winding basin, without which even the deeper harbor would be of very little use to the large steamers which it is now proposed to use at this harbor, since with the present turning basin such steamers would find it impossible to wind.

It is the opinion of the Board that, prior to any further improvement of South Haven Harbor by the General Government, proper dock lines should be established and suitable bulkheads should be built along these lines by the riparian owners, and the property lying on the channel side of these dock lines should be deeded to the Government free of cost. The Board believes that, after these conditions have been complied with, the improvement of the harbor to a depth of 16 feet, as proposed by the district officer, is warranted by the present and reasonably prospective commerce, and that it will then be desirable for the United States to undertake the work.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

## COMMERCIAL STATISTICS.

[Furnished by the Dunkley-Williams Company.]

The business of the port of South Haven, both in freight and passengers, has been steadily increasing, as will be seen by the following statement of vessels entered and cleared, together with the tonnage:

*Entrances and clearances.*

| Calendar year. | Number. | Tonnage. |
|---|---|---|
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |

*Receipts and shipments by vessel, [illegible].*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| [illegible] | [illegible] | Live stock | [illegible] |
| Lumber | [illegible] | Fruit | [illegible] |
| Live stock | [illegible] | Merchandise | [illegible] |
| Grain | [illegible] | | |
| Merchandise | [illegible] | | |
| Total | [illegible] | Total | [illegible] |

*Receipts and shipments by vessel, [illegible].*

| Articles received. | Tons. | Articles shipped. | Tons. |
|---|---|---|---|
| Salt | [illegible] | Unclassed freight | [illegible] |
| Lumber | [illegible] | | |
| Unclassed freight | [illegible] | | |
| Total | [illegible] | | |

*Receipts and shipments by vessel, 1902.*

[Based on actual records to October 1, and estimated to close of season.]

| Articles received. | Tons. | Value. | Articles shipped. | Tons. | Value. |
|---|---|---|---|---|---|
| Flour and bran | 20,000 | $560,000 | Merchandise | 19,883 | $3,976,600 |
| Corn | 2 | 20 | Fruit | 22,500 | 1,125,000 |
| Lumber | 7,423 | 90,000 | | | |
| Merchandise | 18,500 | 3,700,000 | | | |
| Total | 45,925 | 4,350,020 | Total | 42,383 | 5,110,600 |

During the past year a line has been established between South Haven and Milwaukee in connection with the Michigan Central Railroad, which provides through service between the Northwest and the East for flour, bran, middlings, and general merchandise. The Michigan Central has built over 2½ miles of side tracks and dock tracks to take care of this business at an expense of $25,000. The steamer *Petoskey*, which was placed upon this run, has a capacity exceeding 770 tons and draws 13 feet 6 inches aft when loaded. Owing to the condition of South Haven Harbor, which can not boast of an average depth of over 10 feet, we have been compelled to load the steamer with not to exceed 500 tons cargo, which represents a loss in revenue of nearly 30 per cent. The business offered has been very heavy and would have provided full loads each trip had we been able to get into the harbor. A small amount of dredging was done early in the summer by the Government, but not enough to provide sufficient water to last through the season, and as a result all of the steamers have been striking the bar at the entrance to the harbor, inflicting damage which rendered necessary dry-dock repairs amounting to several thousand dollars. The steamers have also been dragging on the bottom inside and injury has resulted from it.

Owing to the shallow water in the river we have experienced considerable trouble in getting our steamers out of the harbor, and while dragging on the bottom have found it impossible to properly steer the vessels, and in consequence have collided with piers and docks and schooners lying at the docks, causing no little damage. Below will be found copy of a report of such an occurrence from Capt. J. M. Mitchell, of the steamer *Petoskey:*

South Haven, Mich., *September 23, 1902.*

Dear Sir: While taking the *Petoskey* from our dock to the lake last night I had great difficulty in steering her on account of being loaded a little deeper than usual. She was drawing 11 feet 3 inches aft and 8 feet 6 inches forward, and she dragged the bottom from the time I started until she cleared the river. At the inner end of the Government piers there is a sharp bend, and to make this when a boat is dragging the bottom you must open her up. In making said bend last night I found a steam tug in my way (she was made fast to the piers), which necessitated stopping and backing the boat; but being too near the pier to fully stop before reaching it, my boat collided with the same, striking the pier just ahead of the tug and forcing her away from the dock or piers, doing slight damage, if any, to my boat. I have no means of knowing to what extent the piers were damaged by the collision, if at all. The contact with the piers was so light that I felt I had gotten off cheaply, for I had just narrowly escaped being driven into the Midway pavilion by my boat taking a sheer on striking an extra shoal spot right there.

Respectfully, yours,

J. M. Mitchell,
*Master Steamer Petoskey.*

Mr. R. W. Crary,
*Third Vice-President and Auditor South Haven Line,*
*South Haven, Mich.*

The growing importance of South Haven as a summer resort, with its 200 hotels and resorts, is best known by the following figures of passengers carried in recent years:

| | |
|---|---|
| 1900 | 127,744 |
| 1901 | 139,670 |
| 1902 (estimated) | 150,000 |

These people distributed themselves among the resorts and farms along the lake shore for 10 miles north and 10 miles south.

The increase in the passenger business and the prospect for still further increase with improved service has rendered it imperative that larger and swifter boats be placed upon the Chicago route to accommodate the thousands who desire to take their outings in the heart of the peach belt of Michigan. We are ready to place a larger boat upon the run, but a boat of the dimensions needed for this business would draw more water than is to be found in the South Haven Harbor, and would be too long to turn around in the present winding basin. South Haven is the only port serving a large and growing fruit country, producing annually 5,000,000 to 6,000,000 packages. It is the terminus of the South Haven division of the Michigan Central Railroad and of the South Haven and Easton Railroad, and is the shipping point for the following towns located on these lines:

Lawton, producing 1,000 cars of grapes annually.

Paw Paw, thriving manufacturing town and fruit shipping point, county seat.

Lake Cora, summer resort.

Lawrence, Hartford, Toquin, Covert, Packard, Fruitland, Bangor, Lacota, Kibbies, Grand Junction, Berlamont, Gobles, Bloomingdale, Breedsville, Glenn, Fennville, Hoppertown, and Bravo, having canneries, pickle factories, cider mills, grape-juice factories, creameries, brickyards, flour mills, and being shipping points for hay, oats, corn, wheat, peaches, pears, plums, grapes, and apples and all kinds of garden and farm produce.

Watervliet and Coloma, adjacent to Paw Paw Lake, the famous summer resort, accommodating over 20,000 people each season.

Among the definite ways of showing the rapid and substantial growth and business of South Haven and the surrounding country, and its warrant for harbor improvements, are the following:

First. The increase of money as partially shown by the two banks' deposits:

September 30—

| | |
|---|---|
| 1898 | $419,392.47 |
| 1899 | 460,252.62 |
| 1900 | 633,687.82 |
| 1901 | 681,358.86 |
| 1902 | 900,289.40 |

Second. Transfers of property obtained from county records and from real estate men were, in 1897, $176,000; in 1901-2, $1,114,000.

Third. New buildings, additions or improvements, including in the city of South Haven money spent for water, electric lights, sewers, and cement walks, railroad extensions and side tracks, new docks, and warehouses, for 1897, $296,000; from January, 1900, to September 30, 1902, $1,714,230.

The surrounding country has led the village in substantial improvements in clearing land; setting fruit trees, plants, and vines; and in new farm buildings and additions.

While many electric lines to terminate at South Haven have been talked about, three have been surveyed, a good deal of right of way obtained, and every assurance is given that the lines will be in operation next summer, thus creating an enormous travel toward the lake at South Haven.

A new boat company is being formed, with a capital of $250,000, claiming it will be ready with one fast, commodious steamer by June, 1903.

Fourth. Population of South Haven village (now city), as shown by the census for 1890, 1,624; 1895, 2,448; 1900, 4,009.

The ordinary estimate by voters and school children would give the city, at this date, over 5,000.

The adjacent country has kept pace with the city in its increase of population.

The village schools, in 1895, had 12 teachers and 638 scholars; the city schools, in 1902, had 23 teachers and 946 scholars. The city has the same territory as the village, except about 50 scholars were left out, as they live outside the city limits.

From the foregoing, it will be seen South Haven and the country surrounding has enjoyed a remarkable growth, which is entirely healthy and apparently permanent, and from all indications will outstrip all former efforts in the next few years. A very large number of fruit trees has been set out within the past few years, which are now coming into bearing, and the fruit production is estimated by experts to increase more than 100 per cent in the next three years.

The summer-resort business can be increased enormously with the assistance of large, fast boats, and the only impediment to placing such steamers upon the route is the lack of proper harbor facilities.

We would most earnestly and respectfully plead for a depth of channel not less than 18 feet, a winding basin sufficient for our steamers, and for an extension of the [illegible] into deep water, to avoid the forming of bars at the entrance to the harbor.

fully submitted.

Dunkley-Williams Company,
R. W. Crary, *Third Vice-President and Auditor.*

The foregoing facts and figures were prepared with the assistance of Mr. C. J. Monroe, president of the First State Bank; Mr. L. E. Parsons, cashier of the Citizens' State Bank; Mr. H. E. Dewey, deputy collector of customs; Mr. S. J. Dunkley, president Dunkley-Williams Company, and others.

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## SURVEY OF SOUTH HAVEN HARBOR, MICHIGAN.

UNITED STATES ENGINEER OFFICE,
*Grand Rapids, Mich., January 10, 1903.*

GENERAL: In compliance with the requirements of Department letter of December 16, 1902, directing that a survey and estimate of the cost of improving South Haven Harbor, Michigan, to a depth of 16 feet to be made, and that a report be rendered thereon, I have the honor to invite attention to the following report.

Sufficient information derived from frequent surveys, the latest of which was made in April, 1902, is now available in this office to obviate the necessity of a special survey and any expense incident thereto. The project and estimate which follow are based upon the condition of the harbor as shown in the survey of April, 1902.

South Haven Harbor, Michigan, is situated at the mouth of Black River, a small stream of relatively insignificant discharge, the harbor deriving its name from the village of South Haven, which lies at the south side of the river mouth. Improvement of this harbor by the United States was begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers which had been built by residents of the vicinity. Since 1867 the work of improvement has proceeded under the project of 1866 as modified in 1869, 1872, and 1888, which provides for constructing parallel piers and revetments 175 feet apart at the mouth of Black River with the object of procuring a channel 12 feet deep, this depth being extended by dredging one-half mile up Black River to the highway bridge. To June 30, 1902, the total expenditure was $299,965.59, of which $112,732.76 was applied to maintenance by dredging and repair of existing structures.

Up to the present time the method adopted for improving this harbor has been the same as that employed at other harbors upon the east shore of Lake Michigan. The natural banks at the river mouth have been prolonged by parallel piers or jetties, consisting either of pile or of cribwork, these being extended into the lake to a point at which it was hoped the natural depth existing at the time might indefinitely continue without deterioration due to natural causes. As in the case of other harbors upon this shore, this expectation has not been entirely fulfilled. The bed and the shores of Lake Michigan, in this vicinity, consist of fine sand, easily set in motion by the action of winds, waves, and currents. In this movement, the increasing obstruction, formed by the protrusion of the piers beyond the natural shore line, interfered, and the lake shore line was correspondingly advanced, the rate of the outward progress of the shore line being dependent upon the rate of pier extension. The final result is clearly shown upon the chart of South Haven Harbor, which is forwarded herewith, this showing the shore line of the earliest authentic survey, that of June, 1870, and also the shore line of the latest survey, that of April, 1902. The map also shows the contours of depths beyond the shore line.

To supplement the 1870 survey, which extends only to the 15-foot contour, the 20, 25, and 30 foot contours are taken from the survey of August, 1871. Between June, 1870, and August, 1871, there could have been but little change of the lake bottom in the vicinity of these contours. Between 1870 and 1902 the shore line in the vicinity of the piers has moved westward from 175 to 200 feet, and so far as available information can establish the facts, it is probable that the movement has been uniform for a considerable distance on each side of the entrance. So far as the contours are established by the survey of 1870, a comparison of the two surveys shows relatively small change in the 5, 10, and 15 foot contours; but the shoaling near the 20, 25, and 30 foot contours, immediately in front of the entrance, is more marked. Neither survey is sufficiently extensive to justify general conclusions, and it is perhaps true that the deeper contours of the earlier survey were not as reliably determined as those in shallower water. The general shoaling of the lake bottom in the vicinity of the entrance, usually found at other sandy harbors upon the east shore of Lake Michigan, has not apparently taken place at South Haven to as great an extent as elsewhere. A further extension of the piers at South Haven may then produce beneficial and reasonably permanent results to a somewhat greater degree than has been the case at other harbors in the district.

It should, however, be noted that the survey of 1902 shows immediately in front of the entrance a bar upon which the depth referred to the gauge zero is as little as 11.8 feet. This bar is not shown in the earliest surveys, but for the past ten years has been fairly persistent. The formation of such bars is apparently an unavoidable accompaniment of the method of improvement by means of parallel piers, but the quantity of material in the bar is small, and a reasonable expenditure annually for maintenance by dredging will neutralize this effect. In any event, the method of improvement by further extension of the piers is proposed only because the method by dredging seems at present to be out of the question.

The piers and revetments built by the United States have their inner end at the point marked "station O" upon the map. Inside this point to the highway bridge the operations of the United States have been confined to dredging for the creation and maintenance of the authorized depth of channel, and this has been rendered difficult by the fact that the river banks, originally low and swampy, have only recently been properly docked by the property owners upon the south side, while on the north there is no protection above station 10 E. The absence of proper docks is due to the fact that much of the land to the north is still too low to permit any profit to be derived from docks, and to the further fact that until very recently the business of the harbor has not been sufficient to justify docks upon both sides.

Moreover, the upper portion of the harbor is far too narrow to permit vessels to lie upon both sides of the channel, whose width from bank to bank in the vicinity of station 18 E is only 90 feet. As previously stated, however, the absence of proper revetment has led to very rapid deterioration of dredged channels. The latter fact combined with the demand for additional width and wharfage has led to considerable local discussion looking toward the adoption of a harbor line upon the north side. As yet, however, property owners seem to have been unable to agree upon a suitable line, while the agitation of the matter may have contributed to the unwillingness of property owners to build docks at the present water line. It will, however, be impossible to maintain a 16-foot channel unless efficient docks exist upon both banks, and it is believed that these docks should be built upon the lines shown so as to afford a channel of approximately 200 feet width. Such property as may lie upon the channelward side of the proposed harbor lines should be deeded to the United States free of all cost, and it seems proper that no appropriation for the further improvement of this harbor be made until the above property has been acquired by the United States and properly constructed docks upon the lines shown have been built by the riparian owners. The adoption of the harbor lines shown will also permit the dredging of a larger winding basin, without which even the deeper harbor would be of very little use to the large steamers which it is now proposed to use at this harbor, since with the present turning basin such steamers would find it impossible to wind.

To create a channel at this harbor whose available depth shall never be less than 16 feet requires not only a consideration of the periodic fluctuation of lake levels, but at the entrance the effect of seas must be allowed for. For the past ten years the mean stage in March and April has been very nearly 2 feet below the gauge zero, and in October and November the lake surface has had practically the same level as in the two spring months. To render certain the existence of a 16-foot channel throughout the season of navigation requires, therefore, that dredging in the upper part of the harbor be carried to a depth of 19 feet referred to the gauge zero, this depth assuring at least 1 foot of water under the keel of a vessel of 16-foot draft with the gauge reading −2 feet. At the entrance the allowance for the effect of seas in temporarily diminishing available depths should certainly be not less than 2 feet, which would require dredging to not less than a depth of 21 feet. The latter depth fixes approximately the point at which pier extensions, if the improvement is to be brought about by such means, should terminate.

To bring about the desired increase in channel depth at the entrance two general methods are available. Both involve the reconstruction of such portions of existing structures as would be rendered unstable by dredging to increased depths. The first method is that which has hitherto been the only one in use at the harbors of this district. This consists in extension of both piers to a point where the existing depth is equal to that which it is proposed to create by dredging—in this case 21 feet. This pier extension alone will give no increase of depth, except immediately at the ends of the piers, and it must be supplemented by dredging to the depths previously mentioned. Annual deterioration of moderate extent is certain even where the piers end in relatively deep water, and this must be overcome by annual dredging of moderate quantities of material. Such pier extension adds materially to the length of structures necessary to be maintained, in this case the extension being 800 feet in length for each pier, and the added annual cost of maintenance due to these additions alone being about $1,600.

The alternative method for creating the desired depths at the entrance is dredging upon a scale sufficiently extensive to remove the annual accretions at the entrance, the piers to remain at their present length. This dredging would necessarily have to be carried well to the north of the north and to the south of the south pier. The latter method has as yet not been tried upon Lake Michigan, and to render it an economical alternative for the former method requires the use of a seagoing hydraulic dredge. At present dipper dredges are the only ones available upon Lake Michigan and no further discussion of the second method seems profitable. It may, however, be stated that it is probable that the annual deposit of sand at this harbor is less than 100,000 cubic yards, and that were a dredge of proper type available the second method for improving the entrance would unquestionably prove the more satisfactory. It has already been pointed out that deterioration at this harbor during the past thirty-two years has been comparatively slow, and while data are lacking to decide whether or not this moderate rate of deterioration will continue after the piers have been extended, it is not probable that any marked change in the rate of accretion will take place. For this reason the results derived from improvement of the entrance by pier extension will be reasonably permanent, and the project and estimate of cost for creating the desired depth are based upon this fact.

The map which is herewith shows in outline the pier extensions and the dredging necessary to create and render always available a 16-foot depth of channel. It is proposed to extend each pier 800 feet, the extensions to consist of cribs such as are now in use in this district, all but the last outer 100 feet in each pier to be 16½ feet deep below zero of the gauge. The end cribs will be 18½ feet deep and all cribs will be upon pile foundations. The four inner cribs of each pier extension are designed to be 24 feet wide, and the remainder 30 feet wide, while all of them will be surmounted by a timber superstructure 6 feet high. As shown upon the map, the piers will not be parallel but will diverge slightly, so as to make the width at the proposed entrance 200 feet. The present width of slightly over 170 feet seems scarcely sufficient for large vessels, especially during storms. To permit the necessary dredging without undermining the older works will require the following repairs: Nine hundred and twenty-seven feet of the north pier between stations 0+60 and 9+87 is old pile work and should be sheet-piled. The shallow cribs between stations 9+87 and 13+39 should be reenforced by round piles and new superstructure. To facilitate navigation the old pile work between stations 0 and 0+60 of the north pier should be removed. In the south pier sheet piling will be needed between stations 8+54 and 9+97 and the old crib work between stations 9+97 and 13+53 will require reenforcement by round piles and new superstructure.

As previously explained, the dredging should be carried to the depths shown with a width of 120 feet between the piers and 90 feet above them, the winding basin being 300 feet wide, measured at right angles to south dock opposite. The side slopes of the dredged cuts are to be not steeper than 1 vertical to 3 horizontal. Based upon these premises the estimate for the 16-foot channel is as follows:

| | |
|---|---|
| Extension of piers— | |
| 800 feet crib work, 24 by 22½ feet, at $90 | $72,000 |
| 600 feet crib work, 30 by 22½ feet, at $110 | 66,000 |
| 200 feet crib work, 30 by 24½ feet, at $120 | 24,000 |
| | 162,000 |
| **Repairs**, north pier— | |
| 927 feet sheet piling, at $25 | 23,175 |
| 352 feet round piling and superstructure, at $15 | 5,280 |
| **Removing** 60 feet old revetment, at $10 | 600 |

| | |
|---|---|
| Repairs, south pier— | |
| 143 feet sheet piling, at $25 | $3,575 |
| 356 feet round piling and superstructure, at $15 | 5,340 |
| Dredging 270,000 cubic yards, at 20 cents | 54,000 |
| | 253,970 |
| Add 10 per cent for contingencies, superintendence, etc | 25,400 |
| Total | 279,370 |

In addition there will be required not less than $10,000 annually for maintenance by dredging and repair of existing structures.

Based upon the facts cited in my preliminary report of October 15, 1902, I have the honor to state that in my opinion the improvement of South Haven Harbor to a depth of 16 feet, at a total cost of $279,370, is one worthy of being made. No additional facts or arguments other than those contained in the above preliminary report can now be adduced further than the statement that since the submission of this report a contract has been entered into for the large boat mentioned in the statement of Mr. R. W. Crary, third vice-president and auditor of the Dunkley-Williams Company. This steamer will be 245 feet long over all, with a draft of about 13½ feet. In other words, the new steamer will be 74 feet longer than the largest of the boats now regularly in service at South Haven. In addition, a new company, called the Michigan Steamship Company of South Haven, has been organized for the purpose of entering into the freight and passenger business between South Haven and Chicago, and this company has entered into contract for a steamer 275 feet long over all, 38 feet beam, and 23 feet depth. With these new steamers in regular service, as they are expected to be before July 1, much ampler facilities for navigation than now exist will soon be required.

Very respectfully, your obedient servant,

CHARLES KELLER,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 13, 1903.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

# APPENDIX N N.

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## IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF MICHIGAN.

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*REPORT OF MAJ. LANSING H. BEACH, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. Cheboygan Harbor, Michigan.
2. Alpena Harbor (Thunder Bay River), Michigan.
3. Saginaw, Flint, Shiawassee, and Bad rivers, Michigan.
4. Sebewaing River, Michigan.
5. Harbor of refuge at Sandbeach (Harbor Beach), Lake Huron, Michigan.
6. Mouth of Black River, Rouge River, and Monroe Harbor, Michigan.
7. Black River at Port Huron, Michigan.
8. Pine River, Michigan.
9. Belle River, Michigan.
10. Clinton River, Michigan.

### EXAMINATION.

11. Pointe Aux Barques Harbor, Michigan.

UNITED STATES ENGINEER OFFICE,
*Detroit, Mich., July 14, 1904.*

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1904.

Very respectfully,

LANSING H. BEACH,
*Major, Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

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## N N 1.

## IMPROVEMENT OF CHEBOYGAN HARBOR, MICHIGAN.

No work was in progress during the past year.

| | |
|---|---|
| Original estimated cost of dredging and pier construction, 1871 | $395,000.00 |
| Whole amount expended to June 30, 1904 | 173,689.74 |

## *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,760.89 |
| Refunded to assistant treasurer, Chicago, on account of disallowance by Chief of Engineers | 1.00 |
| | 2,761.89 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 450.63 |
| July 1, 1904, balance unexpended | 2,311.26 |

| | | |
|---|---|---|
| Amount (estimated) required for completion of existing project | | 5,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $5,000.00 | |
| For maintenance of improvement | 4,000.00 | |
| | | 9,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1871 | $10,000 | August 2, 1882 | $10,000 |
| June 10, 1872 | 15,000 | July 5, 1884 | 5,000 |
| March 3, 1873 | 15,000 | August 5, 1886 | 15,000 |
| June 23, 1874 | 15,000 | August 11, 1888 | 15,000 |
| March 3, 1875 | 15,000 | June 3, 1896 | 12,000 |
| August 14, 1876 | 10,000 | March 3, 1899 | 8,000 |
| June 18, 1878 | 8,000 | June 13, 1902 | 8,000 |
| March 3, 1879 | 3,000 | | |
| June 14, 1880 | 6,000 | Total | 176,000 |
| March 3, 1881 | 6,000 | | |

### COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Mr. C. L. Marquette, deputy collector of customs, Cheboygan, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Brick | 187 | |
| Cedar posts | | 12,128 |
| Cedar ties | 22 | 21,587 |
| Coal | 9,569 | 985 |
| Flour | 550 | |
| Grain | 134 | |
| Hay and feed | 75 | 200 |
| Potatoes | | 3 |
| Lath | | 414 |
| Leather | | 100 |
| Lime and cement | 330 | 30 |
| Live stock | 25 | 7 |
| Logs | | 136,500 |
| Lumber | 10,000 | 75,461 |
| Machinery | 262 | |
| Merchandise, general | 8,650 | 4,872 |
| Salt | 140 | 9 |
| Shingles | | 817 |
| Beer | | 19 |
| Tan bark | | 290 |
| Telegraph poles | | 5,457 |
| Paper pulp | 370 | |
| Fuel | 208 | |
| Fish, packages | 12 | 13 |
| Spiles | | 290 |
| Pulp wood | 2,400 | |
| Furniture | 44 | 10 |
| Boom sticks | 750 | 162 |
| Total | 33,728 | 259,224 |

## N N 2.

## IMPROVEMENT OF ALPENA HARBOR (THUNDER BAY RIVER), MICHIGAN.

No work was necessary during the past year. Past experience justifies the expectation that the improved channel will deteriorate very slowly and that no expenditure for maintenance or restoration is likely to be needed in the near future. The large area of impounded water above the dam seems to serve as a settling basin, and but little sediment appears to be carried into the portion of the channel already dredged. For this reason it is not considered necessary to submit an estimate for further appropriation at present.

| | |
|---|---|
| Original estimate of cost, 1876, 1881, and 1889 (aggregate) | $55,851.48 |
| Whole amount expended to June 30, 1904 | 49,674.07 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,825.93 |
| July 1, 1904, balance unexpended | 1,825.93 |

APPROPRIATIONS.

| | |
|---|---|
| Thunder Bay Harbor, Michigan: | |
| August 14, 1876 | $4,500 |
| August 2, 1882 | 15,000 |
| September 19, 1890 | 5,500 |
| Thunder Bay River, Michigan: | |
| September 19, 1890 | 10,000 |
| July 13, 1892 | 10,000 |
| Alpena Harbor, Michigan: | |
| August 18, 1894 | $4,000 |
| June 3, 1896 | 2,500 |
| Total | 51,500 |

COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by the deputy collector of customs at Alpena, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Brick | 725 | |
| Cedar posts | | 14,275 |
| Cedar ties | | 39,069 |
| Coal | 28,997 | |
| Farm products, miscellaneous | 600 | |
| Fish | | 888 |
| Flour | 1,290 | |
| Fruit, miscellaneous | 150 | |
| Grain | 1,071 | |
| Hay and feed | 16,400 | |
| Laths | | 650 |
| Leather | | 1 |
| Lime and cement | | 9,106 |
| Live stock | 35 | |
| Lumber | | 80,234 |
| Machinery | 400 | 150 |
| Merchandise, general | 10,477 | 2,841 |
| Paper | 37 | 300 |
| Salt | 1,043 | |
| Shingles | | 958 |
| Telegraph poles | | 750 |
| Unclassified freight | 7,000 | 4,000 |
| Hides | 3 | |
| Pulp wood | 1,288 | |
| Ground pulp wood | 205 | |
| Total | 69,721 | 153,222 |

## N N 3.

### IMPROVEMENT OF SAGINAW, FLINT, SHIAWASSEE, AND BAD RIVERS, MICHIGAN.

Dredging operations under contract with Messrs. G. H. Breymann & Bros., of Toledo, Ohio, were in progress at the commencement of the fiscal year, and were continued until October 21, 1903. Channels were dredged through two shoals in Bay County to a depth of 14 feet, removing 15,500 cubic yards of material, and through six shoals in Saginaw County to a depth of 12 feet, removing 31,623 cubic yards, and 58,984 cubic yards were taken from the bar at the mouth of the river, practically completing it 200 feet wide and 16 feet deep.

The wreck of the *Garden City*, which lay a short distance below the Interurban Railway bridge, was removed in October, 1903, by blasting and dredging.

No work was done upon the Flint, Shiawassee, or Bad rivers, the conditions apparently not warranting any expenditure.

| | |
|---|---|
| Estimated cost of successive projects, 1867 to 1882 | $289,795.00 |
| Estimated cost of project for 1882 | 446,000.00 |
| Total | 735,795.00 |
| Carried to surplus fund | 1,000.00 |
| Whole amount expended to June 30, 1904 | 806,636.96 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | [a]$62,065.54 |
| Deposited by Auditor for War Department September 17, 1903, on account of voucher 50, April, 1900, accounts of Colonel Lydecker | | 1.08 |
| | | 62,066.62 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $13,654.76 | |
| For maintenance of improvement | 17,296.98 | |
| | | 30,951.74 |
| July 1, 1904, balance unexpended | | 31,114.88 |
| July 1, 1904, outstanding liabilities | | 147.00 |
| July 1, 1904, balance available | | 30,967.88 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $40,000.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 50,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

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[a] Including $0.76 returned by Major Beach, October 1, 1902, on account of disallowance by Auditor for War Department.

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| June 23, 1866 | $67,500.00 | August 11, 1888 | $65,000.00 |
| March 2, 1867 | 28,000.00 | September 19, 1890 | 75,000.00 |
| July 25, 1868 (allotment) | 9,000.00 | July 13, 1892 | 100,000.00 |
| July 11, 1870 | 1,500.00 | August 18, 1894 | 40,000.00 |
| June 23, 1874 | 15,000.00 | June 3, 1896 | 40,000.00 |
| March 3, 1875 | 30,000.00 | March 3, 1899 | 40,000.00 |
| August 14, 1876 | 11,000.00 | June 13, 1902 | 50,000.00 |
| June 18, 1878 | 25,000.00 | Repayments | 1.84 |
| March 3, 1879 | 8,000.00 | | |
| June 14, 1880 | 15,000.00 | Total | 838,751.84 |
| March 3, 1881 | 10,000.00 | Carried to surplus fund | 1,000.00 |
| August 2, 1882 | 125,000.00 | | |
| July 5, 1884 | 50,000.00 | Balance | 837,751.84 |
| August 5, 1886 | 33,750.00 | | |

CONTRACT IN FORCE.

Contract in force with Messrs. G. H. Breymann & Bros., of Toledo, Ohio, for dredging, approved January 30, 1903, at 20 cents per cubic yard, scow measurement, for dredging bar at mouth, 16 cents per cubic yard in Bay County, and 21 cents per cubic yard in Saginaw County. Work on the contract ceased October 21, 1903.

COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Mr. Wm. G. Emerick, deputy collector, Saginaw, Mich., and Mr. Dewitt C. Brawn, deputy collector, Bay City, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Cedar posts | 500 | .......... |
| Coal | 13,558 | 75 |
| Fish | 777 | .......... |
| Iron and ore | 350 | 100 |
| Lath | 8,291 | .......... |
| Cement | .......... | 2,400 |
| Logs | 84,000 | .......... |
| Lumber | 242,432 | 2,661 |
| Merchandise, general | 400 | 230 |
| Salt | .......... | 12,533 |
| Stone | 13,330 | .......... |
| Ties | 742 | .......... |
| Pickets | 899 | .......... |
| Total | 359,779 | 17,999 |

## N N 4.

## IMPROVEMENT OF SEBEWAING RIVER, MICHIGAN.

At the beginning of the fiscal year the work of dredging the channel contemplated by the project under contract with Campbell Brothers, of Sault Ste. Marie, Mich., was still in progress, the time for completion of the contract having been waived December 4, 1901, for a reasonable period. The contractors had one dredge at work July 1, 1903, and continued operations until September 9, 1903.

The material excavated varied from soft mud and sand, which had deposited in the trench and which it was necessary to remove in order to provide an exit for the dump scows, to the hardest kind of hardpan, which almost resembled rock in its consistency, ordinary dippers making practically no impression upon it.

Dredging operations under contract with Campbell Brothers, dated August 21, 1899, which were commenced October 14, 1899, were discontinued September 9, 1903. The result of the work has been to secure a channel about 3 miles long, extending from the mouth of the river to the 8-foot depth in Saginaw Bay. The width varies slightly throughout this distance. Beginning at the outer end, it is about 80 feet for the first 3,000 feet, 90 feet for the next 5,600 feet, and 70 feet for the next 5,500 feet. All dredging was done to secure a depth of 8 feet.

A shoal with but 2 feet of water over it was formed in the channel just beyond the mouth of the river by the spring freshets, imprisoning some boats in the river. A cut 35 feet wide was made through this by the Bay City Dredging Company, May 22 to 27, 1904, by overcasting the excavated material, at a cost of $570. No dump scows were available which could be used in that channel, and as the small balance of funds available did not permit the bringing of any from a distance, the method adopted was the only practicable way of releasing the vessels in the river.

Owing to the fact that the cut in the bay is at right angles to the littoral drift there is a constant tendency to fill, this filling being sufficiently rapid to destroy the channel in a very few years. The use of dikes or training walls would not be effective, as the volume of discharge from the river is insufficient to produce the necessary scour, and currents in the bay are too variable to be utilized. The river is unable to maintain a channel of more than 5 feet between its banks. Constant dredging will therefore be the only means of maintaining the work.

As a result of the redredging necessary the available funds were insufficient to provide the channel contemplated by the project, and $15,000 are estimated as necessary to increase the channel width from 75 feet now obtained to 100 feet. To this should be added $4,000 for redredging in the river, which has shoaled to such an extent as to practically exclude vessels, and from which about 20,000 cubic yards should be removed to provide a channel 8 feet deep. The amount which will be necessary for annual maintenance can best be stated after a year or two of further experience.

The total amount of material excavated under the contract with Campbell Brothers was 196,130 cubic yards.

| | |
|---|---|
| Original estimated cost of work, 1895 | $37,000.00 |
| Whole amount expended on the present project June 30, 1904 | 36,461.22 |

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $7,953.81 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $6,845.03 | |
| For maintenance of improvement | 570.00 | |
| | | 7,415.03 |
| July 1, 1904, balance unexpended | | 538.78 |
| Amount (estimated) required for completion of existing project | | 15,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $15,000.00 | |
| For maintenance of improvement | 5,000.00 | |
| | | 20,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | |
|---|---|
| March 3, 1875 (river and harbor) | $8,000 |
| June 14, 1880 | 7,000 |
| June 3, 1896 | 5,000 |
| March 3, 1899 | 32,000 |
| Total | 52,000 |

### CONTRACT IN FORCE.

Contract in force with Campbell Brothers for dredging Sebewaing River, Michigan, approved September 13, 1899; date of beginning work, October 14, 1899; date of expiration, September 30, 1900. Extended to December 31, 1900, and to December 1, 1901. Time for completion waived for a reasonable period December 4, 1901. Completed as far as available funds would permit September 9, 1903.

### COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Messrs. John C. Linken & Co., of Sebewaing, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Brick | | 250 |
| Cedar posts | | 70 |
| Coal | 3,600 | 4,000 |
| Farm products | | 19,000 |
| Fish | | 200 |
| Flour | 100 | 720 |
| Fruit, miscellaneous | 40 | 180 |
| Grain | 2,000 | 290 |
| Hay and feed | | 2,400 |
| Lath | 1,450 | |
| Lime and cement | 200 | |
| Live stock | | 450 |
| Logs | | 600 |
| Lumber | 1,800 | |
| Machinery | 100 | |
| Merchandise, general | 50 | 1,000 |
| Salt | 165 | |
| Shingles | 2,600 | |
| Unclassified freight | 2,400 | 750 |
| Total | 14,405 | 29,910 |

## N N 5.

## IMPROVEMENT OF HARBOR OF REFUGE AT SANDBEACH (HARBOR BEACH), LAKE HURON, MICHIGAN.

Bids for rebuilding in concrete as much of the superstructure of the main pier as could be done for $200,000 were received July 18, 1903, and the work awarded to the lowest bidders, Hugo & Tims, of Duluth, Minn., at prices which amount to $115.51 per linear foot of breakwater. Owing to the lateness of the season and its stormy nature the contractors were unable to begin operations in the fall of 1903, and, although ready to begin work at the opening of navigation in the spring of 1904, it was not until June 11 that they were able to get their barges out of Lake Superior on account of the ice.

The following statements made in last year's report concerning the necessity of modifying the project for the harbor in some respects, so as to permit it to conform with requirements of present navigation, are again included:

In addition to the permanent superstructure already authorized, the harbor should be otherwise improved in order to be equal to the present demands made upon it. The number as well as size of vessels has so increased since its establishment that the facilities which were ample a few years ago are now inadequate to enable all vessels which would like to do so to avail themselves of its advantages. The work which should be done to make the harbor fully adequate to present conditions is as follows:

(*1*) *Widening the entrance.*—This is at present but 600 feet wide, facing directly east, and has been found to be rather narrow in heavy seas with north, northeast, or southeast winds, and vessels with barges in tow frequently hesitate to make the attempt, and sometimes find it impossible to enter. This entrance should be widened to 800 feet, and should be deepened by dredging to a depth of at least 23 feet, so as to avoid any danger of vessels striking the bottom in a heavy sea. The cost of widening the present entrance to 800 feet is estimated as follows: 133,000 cubic yards of rock excavation, $66,500; removing 200 feet of breakwater and rebuilding the end, $9,000; total, $75,500.

(*2*) *Construction of an interior pier, along line A.*—Owing to the fact that the bottom of the harbor is bed rock, it affords no anchorage whatever for vessels, and they are compelled during a storm to tie up to the main pier. This in times of heavy northeast storms causes great discomfort owing to the water and spray thrown over the breakwater and carried by the wind to some distance in the harbor. It also requires vessels to lie against each other owing to lack of space, and there have been occasions when the vessels have had to lie five deep. During a heavy southwest wind the waves raised in the harbor itself are sufficient to cause boats to bump badly against the pier. For the purpose of affording more pier space, and also to permit vessels to lie in the harbor in more comfort, it is recommended that a pier be constructed along line A, as shown on the map. In addition to providing greater comfort in northeast and southwest storms, it will, it is believed, tend also to prevent the deposit of mud in the harbor. It is believed that the work of dredging the harbor, widening and deepening the entrance, and providing a permanent superstructure upon the present breakwaters is of greater importance than the building of proposed interior pier, and should be first executed. All plans and work in the harbor, however, should be made with the construction of this pier in view, and if the pier is authorized, it is believed much of its construction may be accomplished as an incident to the other work.

The sum of $300,000 should be appropriated for improving the harbor during the coming year, of which amount about $100,000 would be applied to widening and deepening the entrance and dredging in the interior of the harbor and $200,000 to continuing the work of constructing permanent superstructure. Owing to the present high prices of labor and materials, a continuing contract to be made at this time is not recommended.

The name "Sandbeach" was given to the locality before the establishment of any harbor, owing to the existence of a small patch of sand along the shore, which along this rocky coast was sufficiently distinctive to be used by mariners as a landmark. Since the construction of the harbor it is no longer so used. The name of the town, railroad station, and the post-office have been changed to "Harbor Beach," which is more in accordance with existing conditions, and it is recommended that this term be hereafter used for the improvement instead of Sandbeach.

Dredging within the limits of the harbor of refuge, under contract with M. Sullivan, of Detroit, Mich., contract dated September 12, 1903, was commenced September 16, 1903, and continued until December 12, 1903, when the contractor was compelled to stop on account of ice. Work was resumed April 22, 1904, and continued until May 7, 1904. Two dredges were placed upon the work by the contractor, and 110,585 cubic yards of material were removed at a cost of $52,465.93.

| | |
|---|---|
| Original estimated cost of the work | $1,442,500.00 |
| Amount carried to surplus fund | 30,000.00 |
| Whole amount expended to June 30, 1904 | 1,294,071.55 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $273,342.69 |
| Appropriated by sundry civil act, approved April 28, 1904 | | 50,000.00 |
| Deposited to credit of United States Treasurer, proceeds of sale of old iron, etc | | 38.38 |
| | | 323,381.07 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 53,606.41 |
| July 1, 1904, balance unexpended | | 269,774.66 |
| July 1, 1904, outstanding liabilities | | 10,981.20 |
| July 1, 1904, balance available | | 258,793.46 |
| July 1, 1904, amount covered by uncompleted contracts | | 200,000.00 |
| Amount (estimated) required for continuation of project | | 300,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $300,000.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 310,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1871 | $100,000.00 | June 13, 1902 | $7,500.00 |
| June 10, 1872 | 100,000.00 | April 28, 1904 | 50,000.00 |
| March 3, 1873 | 75,000.00 | | |
| June 23, 1874 | 75,000.00 | Total | 1,593,500.00 |
| March 3, 1875 | 100,000.00 | Carried to surplus fund | 30,000.00 |
| August 14, 1876 | 75,000.00 | | |
| June 18, 1878 | 100,000.00 | | 1,563,500.00 |
| March 3, 1879 | 75,000.00 | September 4, 1897, amount collected on account of damage to piers and deposited to credit of appropriation | 107.05 |
| June 14, 1880 | 75,000.00 | | |
| March 3, 1881 | 50,000.00 | | |
| August 2, 1882 | 75,000.00 | | |
| July 5, 1884 | 75,000.00 | | |
| August 5, 1886 | 75,000.00 | March 10, 1902, amount collected on account of damage to piers and deposited to credit of appropriation | 200.78 |
| August 11, 1888 | 70,000.00 | | |
| September 19, 1890 | 30,000.00 | | |
| July 13, 1892 | 150,000.00 | | |
| August 18, 1894 | 20,000.00 | | |
| June 3, 1896 | 16,000.00 | Received from sales | 38.38 |
| March 3, 1899 | 50,000.00 | | |
| June 6, 1900 | 150,000.00 | Total | 1,563,846.21 |

### CONTRACTS IN FORCE.

Contract in force with Hugo & Tims, of Duluth, Minn., for rebuilding superstructure of main pier in concrete, approved August 28, 1903, date of beginning work June 12, 1904; and contract in force with M. Sullivan, of Detroit, Mich., for dredging in harbor of refuge, Sandbeach, Mich., approved October 1, 1903, date of beginning work September 16, 1903, date of completion May 7, 1904.

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### COMMERCIAL STATISTICS.

Table No. 1.—*Summary of vessels sheltered in the harbor of refuge at Sandbeach, Mich., from July 1, 1903, to June 30, 1904, and the direction of wind at time of entering the harbor.*

| Direction of wind at time of entering. | 1903. | | | | | | 1904. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Apr. | May. | June. | Total. |
| **North:** | | | | | | | | | | |
| **Steam** | 30 | 17 | 27 | 10 | 9 | 0 | 6 | 3 | 13 | 115 |
| **Sail** | 4 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 9 |
| **Tows** | 5 | 4 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 19 |
| **Total** | 39 | 22 | 33 | 15 | 10 | 0 | 6 | 4 | 14 | 143 |
| **Northwest:** | | | | | | | | | | |
| **Steam** | 12 | 25 | 15 | 36 | 19 | 2 | 0 | 6 | 2 | 117 |
| **Sail** | 0 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 7 |
| **Tows** | 1 | 11 | 8 | 7 | 10 | 0 | 0 | 4 | 0 | 41 |
| **Total** | 13 | 39 | 24 | 46 | 29 | 2 | 0 | 10 | 2 | 165 |
| **West:** | | | | | | | | | | |
| **Steam** | 26 | 15 | 33 | 40 | 35 | 2 | 1 | 4 | 5 | 161 |
| **Sail** | 3 | 4 | 2 | 3 | 1 | 0 | 0 | 0 | 1 | 14 |
| **Tows** | 1 | 0 | 17 | 38 | 14 | 0 | 0 | 0 | 0 | 70 |
| **Total** | 30 | 19 | 52 | 81 | 50 | 2 | 1 | 4 | 6 | 245 |
| **Southwest:** | | | | | | | | | | |
| **Steam** | 10 | 13 | 35 | 17 | 32 | 0 | 1 | 8 | 8 | 124 |
| **Sail** | 1 | 1 | 6 | 5 | 0 | 0 | 0 | 1 | 1 | 15 |
| **Tows** | 0 | 0 | 3 | 4 | 5 | 0 | 0 | 0 | 0 | 12 |
| **Total** | 11 | 14 | 44 | 26 | 37 | 0 | 1 | 9 | 9 | 151 |
| **South:** | | | | | | | | | | |
| **Steam** | 7 | 2 | 17 | 13 | 3 | 5 | 0 | 6 | 4 | 57 |
| **Sail** | 1 | 1 | 4 | 5 | 2 | 0 | 0 | 2 | 2 | 17 |
| **Tows** | 0 | 0 | 4 | 1 | 0 | 2 | 0 | 0 | 0 | 7 |
| **Total** | 8 | 3 | 25 | 19 | 5 | 7 | 0 | 8 | 6 | 81 |
| **Southeast:** | | | | | | | | | | |
| **Steam** | 3 | 15 | 6 | 3 | 14 | 0 | 0 | 5 | 12 | 58 |
| **Sail** | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 6 |
| **Tows** | 1 | 2 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 9 |
| **Total** | 6 | 17 | 6 | 6 | 19 | 0 | 0 | 6 | 13 | 73 |
| **East:** | | | | | | | | | | |
| **Steam** | 1 | 17 | 1 | 2 | 0 | 2 | 0 | 4 | 7 | 34 |
| **Sail** | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 5 |
| **Tows** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **Total** | 2 | 20 | 1 | 3 | 0 | 2 | 0 | 5 | 8 | 41 |
| **Northeast:** | | | | | | | | | | |
| **Steam** | 6 | 6 | 0 | 2 | 0 | 0 | 0 | 13 | 8 | 35 |
| **Sail** | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| **Tows** | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 5 |
| **Total** | 8 | 7 | 0 | 4 | 0 | 0 | 0 | 16 | 9 | 44 |
| **Total each month:** | | | | | | | | | | |
| **Steam** | 95 | 110 | 134 | 123 | 112 | 11 | 8 | 49 | 59 | 701 |
| **Sail** | 14 | 13 | 14 | 19 | 4 | 0 | 0 | 6 | 7 | 77 |
| **Tows** | 8 | 18 | 37 | 58 | 34 | 2 | 0 | 7 | 1 | 165 |
| **Total** | 117 | 141 | 185 | 200 | 150 | 13 | 8 | 62 | 67 | 943 |

**Table No. 2.**—*Classified table of tonnage, by months, sheltered in the harbor of refuge at Sandbeach, Michigan, from July 1, 1903, to June 30, 1904.*

| Date. | Steam. |  | Sail. |  | Tow. |  | Total. |  |
|---|---|---|---|---|---|---|---|---|
|  | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. |
| **1903.** |  |  |  |  |  |  |  |  |
| July | 95 | 91,997 | 14 | 1,661 | 8 | 4,303 | 117 | 97,961 |
| August | 110 | 89,164 | 13 | 1,610 | 13 | 7,394 | 141 | 98,168 |
| September | 134 | 108,060 | 14 | 1,542 | 37 | 20,378 | 185 | 129,980 |
| October | 123 | 108,552 | 19 | 2,726 | 58 | 30,047 | 200 | 141,325 |
| November | 112 | 102,122 | 4 | 385 | 34 | 22,306 | 150 | 124,813 |
| December | 11 | 2,600 | 0 | 0 | 2 | 1,053 | 13 | 3,653 |
| **1904.** |  |  |  |  |  |  |  |  |
| April | 8 | 2,830 | 0 | 0 | 0 | 0 | 8 | 2,830 |
| May | 49 | 23,578 | 6 | 511 | 7 | 3,964 | 62 | 28,053 |
| June | 59 | 55,983 | 7 | 561 | 1 | 672 | 67 | 57,216 |
| Total | 701 | 584,886 | 77 | 8,996 | 165 | 90,117 | 943 | 683,999 |

**Table No. 3.**—*Number and tonnage of vessels sheltered in the harbor of refuge at Sandbeach, Michigan, 1877 to 1903, inclusive.*

| Calendar year. | Steam. | Sail. | Tow. | Total. | Total vessels. | Average tonnage. |
|---|---|---|---|---|---|---|
|  | *Tons.* | *Tons.* | *Tons.* | *Tons.* |  |  |
| 1877 | 63,966 | 27,699 | 50,954 | 142,610 | 493 | 289 |
| 1878 | 104,025 | 39,699 | 99,282 | 243,006 | 781 | 311 |
| 1879 | 133,080 | 45,750 | 100,096 | 278,926 | 921 | 303 |
| 1880 | 158,720 | 55,630 | 147,260 | 361,610 | 1,317 | 275 |
| 1881 | 144,645 | 55,960 | 127,855 | 328,460 | 1,176 | 279 |
| 1882 | 146,132 | 26,504 | 114,067 | 282,703 | 1,022 | 280 |
| 1883 | 177,122 | 32,713 | 114,091 | 328,926 | 1,139 | 284 |
| 1884 | 156,518 | 34,724 | 122,980 | 314,222 | 1,142 | 275 |
| 1885 | 196,364 | 29,426 | 151,607 | 377,397 | 1,158 | 326 |
| 1886 | 196,335 | 33,790 | 140,682 | 370,987 | 1,304 | 284 |
| 1887 | 271,327 | 33,689 | 153,087 | 458,103 | 1,447 | 317 |
| 1888 | 271,917 | 39,756 | 202,191 | 513,864 | 1,624 | 316 |
| 1889 | 287,719 | 37,922 | 165,896 | 493,531 | 1,512 | 326 |
| 1890 | 325,852 | 38,826 | 169,104 | 533,782 | 1,575 | 339 |
| 1891 | 296,917 | 27,076 | 171,067 | 491,060 | 1,341 | 366 |
| 1892 | 362,486 | 29,465 | 162,605 | 554,556 | 1,441 | 385 |
| 1893 | 243,451 | 20,897 | 113,915 | 378,263 | 982 | 385 |
| 1894 | 321,511 | 22,961 | 134,034 | 478,506 | 1,150 | 416 |
| 1895 | 356,532 | 26,898 | 167,827 | 550,668 | 1,204 | 451 |
| 1896 | 246,447 | 24,621 | 105,988 | 377,087 | 1,073 | 351 |
| 1897 | 304,460 | 21,151 | 157,776 | 479,387 | 1,205 | 398 |
| 1898 | 505,630 | 18,090 | 107,176 | 630,980 | 1,204 | 525 |
| 1899 | 590,547 | 20,854 | 81,143 | 692,544 | 1,254 | 544 |
| 1900 | 617,161 | 20,919 | 124,924 | 763,004 | 1,266 | 603 |
| 1901 | 744,154 | 16,841 | 151,023 | 912,018 | 1,338 | 682 |
| 1902 | 747,179 | 21,871 | 124,139 | 893,099 | 1,349 | 662 |
| 1903 | 662,724 | 12,167 | 105,650 | 780,541 | 1,081 | 722 |
| Total | 8,632,919 | 815,809 | 3,566,109 | 13,014,837 | 32,499 | 400 |

## N N 6.

## IMPROVEMENT OF MOUTH OF BLACK RIVER, ROUGE RIVER, AND MONROE HARBOR, MICHIGAN.

### (A) MOUTH OF BLACK RIVER.

No work was in progress at this locality during the past fiscal year.

Original estimated cost (1871) of removing middle ground to depth of—

|  |  |
|---|---|
| 15 feet | $67,320.00 |
| 18 feet | 157,520.00 |
| Whole amount expended to June 30, 1904 | 93,879.88 |

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $5,620.12 |
| July 1, 1904, balance unexpended | 5,620.12 |

---

APPROPRIATIONS.

| | |
|---|---|
| Mouth of Black River, in St. Clair River, Michigan: | |
| June 10, 1872 | $15,000 |
| St. Clair River, at mouth of Black River, Michigan: | |
| March 3, 1873 | 15,000 |
| June 23, 1874 | 15,000 |
| March 3, 1875 | 10,000 |
| June 18, 1878 | 1,500 |
| Mouth of Black River, Michigan: | |
| August 11, 1888 | 10,000 |
| Mouth of Black River, Michigan—Continued. | |
| September 19, 1890 | $10,000 |
| July 13, 1892 | 10,000 |
| August 18, 1894 | 4,000 |
| June 3, 1896 | 4,000 |
| March 3, 1899 | 4,000 |
| June 13, 1902 (allotment) | 1,000 |
| Total | 99,500 |

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## (B) ROUGE RIVER.

The work of dredging this river, begun June 11, 1903, was in progress at the beginning of the fiscal year, and continued until August 21, 1903. A total of 33,439½ cubic yards were excavated through bars in the river. A depth of 21 feet was secured for a portion of the width of the channel from the mouth up, by dredging done by the Detroit Iron and Steel Company, during July and August, 1903, to enable loaded vessels to reach its wharf.

Permanent improvement of the channel is not believed possible, and the river will require periodical dredging for maintenance. An annual amount of $5,000 should be provided for the purpose.

The establishment of the Detroit Iron and Steel Company's large plant near the mouth of the river makes it desirable to bring the largest vessels navigating the Lakes into the river, and it is therefore recommended that the project be amended so as to provide a depth of 21 feet from the mouth of the river to the first bridge across the same, the project remaining as before for the portion of the river above this bridge.

| | |
|---|---|
| Original estimated cost of the work, 1887 | $31,690.39 |
| Whole amount expended to June 30, 1904 | 51,490.28 |

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $4,611.31 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 4,411.59 |
| July 1, 1904, balance unexpended | | 199.72 |
| Amount (estimated) required for completion of existing project | | 28,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $5,000.00 | |
| For maintenance of improvement | 5,000.00 | |
| | | 10,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | |
|---|---|
| August 11, 1888 | $10,000 |
| September 19, 1890 | 10,000 |
| July 13, 1892 | 11,690 |
| August 18, 1894 | 5,000 |
| June 3, 1896 | 5,000 |
| March 3, 1899 (transferred from appropriation for constructing turning basin in Rouge River, Michigan) | 5,000 |
| Total | 46,690 |
| June 13, 1902 (allotment) | 5,000 |
| Total | 51,690 |

### CONTRACT IN FORCE.

Contract in force with Messrs. G. H. Breymann & Bros., of Toledo, Ohio, at 11 cents per cubic yard, scow measurement, approved January 30, 1903. Date of beginning work, June 11, 1903; date of completion of work, August 21, 1903.

### COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the year ended December 31, 1903.*

[Compiled from statements furnished by those doing business along the river front.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Cedar posts | 120 | |
| Cement | 10,000 | |
| Iron ore | 59,470 | |
| Lath | 420 | |
| Limestone | 804 | |
| Lumber | 54,458 | |
| Soda ash | | 10,000 |
| Total | 125,272 | 10,000 |

## (C) HARBOR AT MONROE.

The only work done at this locality during the fiscal year consisted in making minor repairs to the piers. These piers are formed of timber crib work filled with stone. The timber is decaying rapidly and the piers must soon be rebuilt.

For maintenance of the improvement, repairs to the cribs at the entrance, the sum of $5,000 should be provided.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $242.82 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 76.17 |
| July 1, 1904, balance unexpended | 166.65 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 5,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

| | |
|---|---|
| February 24, 1835 | $30,000.00 |
| July 2, 1836 | 15,000.00 |
| March 3, 1837 | 30,000.00 |
| July 7, 1838 | 15,000.00 |
| June 11, 1844 | 20,000.00 |
| August 30, 1852 | 14,000.00 |
| June 23, 1866 | 31,015.27 |
| June 10, 1872 | 10,000.00 |
| March 3, 1873 | 15,000.00 |
| June 23, 1874 | 10,000.00 |
| March 3, 1875 | 10,000.00 |
| August 14, 1876 | 5,000.00 |
| June 8, 1878 | 2,500.00 |
| March 3, 1879 | 2,000.00 |
| June 14, 1880 | $2,000.00 |
| March 3, 1881 | 1,000.00 |
| August 2, 1882 | 1,000.00 |
| August 5, 1886 | 2,000.00 |
| August 11, 1888 | 5,000.00 |
| September 19, 1890 | 5,000.00 |
| July 13, 1892 | 10,000.00 |
| August 18, 1894 | 5,000.00 |
| June 3, 1896 | 5,000.00 |
| March 3, 1899 | 5,000.00 |
| June 13, 1902 (allotment) | 1,500.00 |
| Total | 252,015.27 |

COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the year ended December 31, 1903.*

[Compiled from statements furnished by Mr. Arthur S. Dewey, deputy collector of customs, Monroe, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Brick | 50 | |
| Coal | 250 | |
| Fish | 250 | 175 |
| Sand | 7,000 | |
| Total | 7,550 | 175 |

## N N 7.

## IMPROVEMENT OF BLACK RIVER AT PORT HURON, MICHIGAN.

During September, 1903, a cut 25 feet in width was dredged by Muir Brothers & O'Sullivan, of Port Huron, Mich., through a shoal spot in the river above the Grand Trunk Railway Bridge, 1,750 cubic yards of sand being removed. This cut was subsequently enlarged by the same dredge, the work being done at the cost of the Michigan Sulphite Fibre Company, to enable vessels to reach its wharf.

The total estimated cost of the improvement from the mouth of the river to the Grand Trunk Railway Bridge, with widths varying from 75 to 160 feet, according to locality, was $75,000. No estimate of cost of continuing the work to Washington avenue, as required by the subsequent act, was called for by Congress, and none has been submitted. The total amount appropriated to date is $47,000, and it will require the remaining $28,000 of the estimate to restore the channel and complete it with depth of 16 feet to the limits contemplated by the approved project. If, however, further operations be limited to maintenance of the improvement as it now exists, an appropriation of $8,000 for the year ending June 30, 1906, will suffice.

| | |
|---|---|
| **Original estimated cost of 16-foot channel, 1891** | **$75,000.00** |
| **Whole amount expended to June 30, 1904** | **46,872.90** |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $445.03 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 317.93 |
| July 1, 1904, balance unexpended | 127.10 |

| | | |
|---|---|---|
| Amount (estimated) required for completion of existing project | | 20,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $10,000.00 | |
| For maintenance of improvement | 8,000.00 | |
| | | 18,000.00 |
| Submitted in compliances with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

---

### APPROPRIATIONS.

| | |
|---|---|
| September 19, 1890 | $25,000 |
| July 13, 1892 | 10,000 |
| August 18, 1894 | 4,000 |
| June 3, 1896 | 4,000 |
| March 3, 1899 | 4,000 |
| Total | 47,000 |

---

### COMMERCIAL STATISTICS.

*Receipts by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Mr. Lincoln Avery, collector of customs.]

| Articles. | Received. | Articles. | Received |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Brick | 1,000 | Shingles | 1,230 |
| Cedar posts | 648 | Telegraph poles | 24 |
| Coal | 55,157 | Ice | 1,000 |
| Gravel | 82,500 | Wood | 8,806 |
| Lath | 893 | Pulp wood | 52,000 |
| Lime and cement | 1,875 | | |
| Lumber | 13,549 | Total | 163,265 |
| Salt | 84 | | |

## N N 8.

## IMPROVEMENT OF PINE RIVER, MICHIGAN.

No work was done at this locality during the past fiscal year. A balance of $1,335.41 from the last appropriation is on hand, which will probably suffice to meet all cost of maintenance and general contingencies of engineering, office, etc., for some time to come. Further appropriation is therefore unnecessary at present.

| | |
|---|---|
| Original estimated cost of work, 1895 | $10,560.00 |
| Whole amount expended on present project to June 30, 1904 | 9,224.59 |

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,335.41 |
| July 1, 1904, balance unexpended | 1,335.41 |

APPROPRIATIONS.

| | |
|---|---|
| March 3, 1875 | $5,000 |
| June 3, 1896 | 5,000 |
| March 3, 1899 | 5,560 |
| Total | 15,560 |

COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Mr. David P. Ingles, deputy collector, St. Clair, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Brick | | 4,929 |
| Coal | 6,328 | |
| Wood | 270 | |
| Total | 6,598 | 4,929 |

## N N 9.

## IMPROVEMENT OF BELLE RIVER, MICHIGAN.

No work was done at this locality during the past fiscal year. No additional appropriation is necessary, as the unexpended balance of the last one will provide for all probable expenses of maintenance, supervision, etc., for some considerable time to come.

| | |
|---|---|
| Original estimated cost of work, 1895 | $21,340.00 |
| Whole amount expended on present project to June 30, 1904 | 10,940.46 |

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $4,059.54 |
| July 1, 1904, balance unexpended | 4,059.54 |

APPROPRIATIONS.

| | |
|---|---|
| March 3, 1881 (ice harbor of refuge) | $7,000 |
| August 2, 1882 (ice harbor of refuge) | 5,000 |
| July 5, 1884 (ice harbor of refuge) | 2,000 |
| June 3, 1896 | 5,000 |
| March 3, 1899 | 10,000 |
| Total | 29,000 |

COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Mr. R. B. W. Beattie, deputy collector of customs, Marine City, Mich.]

| Articles. | Received. | Shipped. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Cedar posts | 309 | |
| Coal | 940 | |
| Flour | | 30 |
| Grain | 11 | 14 |
| Gravel | 1,604 | |
| Hay and feed | | 205 |
| Lath | 321 | 30 |
| Logs | 2,100 | |
| Lumber | 6,681 | 985 |
| Shingles | 156 | 19 |
| Slabs | 452 | |
| Stone | 3,030 | 125 |
| Total | 15,604 | 1,408 |

## N N 10.

## IMPROVEMENT OF CLINTON RIVER, MICHIGAN.

Dredging shoals, under contract with Detroit Dredging Company, of Detroit, Mich., was commenced July 3, 1903, and continued until August 5, 1903, a total of 23,535 cubic yards being excavated, and restoring a navigable depth of 8 feet throughout the river below Mount Clemens. The river is liable to the formation of bars at times of freshet, and additional funds should be provided for maintenance of the improvement. An appropriation of $5,000 will probably be sufficient.

| | |
|---|---|
| Original estimated cost of work, 1885, as amended 1899 | $34,564.00 |
| Whole amount appropriated and expended prior to adoption of present project | 25,500.00 |
| Whole amount expended on present project to June 30, 1904 | 47,061.66 |

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $6,742.07 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 4,239.73 |
| July 1, 1904, balance unexpended | 2,502.34 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 5,000.00 |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| August 30, 1852 | $5,000 | September 19, 1890 | $10,000 |
| July 11, 1870 | 5,000 | July 13, 1892 | 8,564 |
| March 3, 1871 | 1,500 | August 18, 1894 | 5,000 |
| March 3, 1881 | 8,000 | June 3, 1896 | 10,000 |
| [illegible] 2, 1882 | 6,000 | | |
| [illegible] 5, 18[illegible] | 6,000 | Total | 75,064 |
| [illegible] | 10,000 | | |

### CONTRACT IN FORCE.

Contract in force with Detroit Dredging Company (Limited), of Detroit, Mich., approved February 21, 1903. Date of commencing work July 3, 1903, and date of completion August 5, 1903.

---

### COMMERCIAL STATISTICS.

*Receipts and shipments by vessel for the calendar year ended December 31, 1903.*

[Compiled from statements furnished by Mr. John T. Rich, collector of customs, Detroit, Mich.]

| Articles. | Received. | Articles. | Received. |
|---|---|---|---|
| | *Tons.* | | *Tons.* |
| Cedar posts | 190 | Salt | [illegible] |
| Coal | 16,280 | Shingles | [illegible] |
| Lath | 21 | Stone | [illegible] |
| Lime and cement | 88 | Sand | [illegible] |
| Logs | 4,767 | | |
| Lumber | 3,560 | Total | 28,411 |

## N N 11.

## PRELIMINARY EXAMINATION AT POINTE AUX BARQUES, MICHIGAN.

[Printed in House Doc. No. 74, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith, for transmission to Congress, a report dated January 15, 1903, by Capt. Lansing H. Beach, Corps of Engineers, on preliminary examination of Pointe Aux Barques, Michigan, with a view to improvement as a harbor of refuge made in pursuance of a requirement in the river and harbor act approved June 13, 1902.

In accordance with the provisions of section 14 of the act, the report has been considered by the Board of Engineers for Rivers and Harbors provided for in section 3 of said act, and its report is made in third indorsement thereon.

In the opinion of the district officer, concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers, the locality is not worthy of improvement, and the Board states in its report that it is not desirable that the United States should undertake the improvement.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

## REPORT OF CAPT. LANSING H. BEACH, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Detroit, Mich., January 15, 1903.*

GENERAL: I have to respectfully submit the following report of preliminary examination of Pointe Aux Barques, Michigan, with a view to improvement as a harbor of refuge.

Pointe Aux Barques is the extreme end of what is known throughout Michigan as the "Thumb"—that is, the peninsula lying between Saginaw Bay and Lake Huron.

The item was inserted in the river and harbor bill, as far as can be ascertained, at the instance of the secretary of the Pointe Aux Barques summer resort association, there being quite a flourishing summer resort at this locality. I can not, however, find any demand on the part of navigation interests for a harbor of refuge at this point, although general inquiry has been made among parties interested or likely to be interested in the navigation of this part of the lake. A large number of vessel captains report that even if a harbor of refuge were established at the Pointe it would not be used, owing to the dangerous rocky coast at this locality, and also to cross seas which would be encountered in reaching it. The bottom of the lake in this vicinity is rock, irregular in formation, but massive, so that even if a harbor should be undertaken at this point the cost of removing the bed rock to an extent sufficient to afford the proper area would be practically prohibitive.

There is at the locality now a small basin near the shore which can be reached by a channel about 300 feet in width. Its navigation, however, is very dangerous, and can be attempted only in calm weather. To enlarge the entrance so that vessels could approach without danger would involve a very large outlay outside of the harbor itself.

It is believed that the harbor of refuge now at Sandbeach, about 25 miles from this locality, serves the purpose more fully and better than a harbor at Pointe Aux Barques could possibly do.

In view of the practically unanimous opinion that the harbor is not only unnecessary, but would not be used if constructed, and the certainty of the enormous cost involved, a survey of the locality is not considered necessary.

The locality is not believed to be worthy of improvement.

Very respectfully,

LANSING H. BEACH,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 16, 1903.*

Respectfully forwarded to the Chief of Engineers.

The opinions that the locality is not worthy of improvement, and that a survey is not necessary, are concurred in.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 5, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brigadier-Genoral Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer, the indorsement of the division engineer thereon, and other data available.

The site of the harbor of refuge at Sandbeach, Mich., was selected in 1873, after careful consideration of the west coast of Lake Huron from Pointe Aux Barques southward for more than 50 miles. At an expense of nearly $1,500,000 a harbor of refuge has been constructed at Sandbeach, and this harbor is but 25 miles (approximately) south of Pointe Aux Barques.

It appears that the harbor contemplated at Pointe Aux Barques is desired largely as a haven for pleasure craft, and no demand for the harbor has been manifested by navigation interests at large.

The bottom near Pointe Aux Barques is of rock and would afford no suitable holding ground for the anchorage of vessels. Moreover, owing to the dangerous nature of the rocky coast in the vicinity, many vessel captains report that a harbor of refuge at this locality would not be used.

The Board is of opinion that it is not desirable that the United States should undertake the improvement of Pointe Aux Barques, Michigan, with a view to improvement as a harbor of refuge.

For the Board:

H. F. HODGES,
*Ma r, Corps of Engineers,*
*Senior Member Present.*

# APPENDIX O O.

## IMPROVEMENT OF WATERS CONNECTING THE GREAT LAKES.

*REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, LIEUT. COL. W. H. BIXBY, MAJ. W. L. FISK, AND LIEUT. COL. CHAS. E. L. B. DAVIS, CORPS OF ENGINEERS.*

### IMPROVEMENTS.

1. Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.
2. St. Marys River at the Falls, Michigan.
3. Operating and care of St. Marys Falls Canal, Michigan.
4. Hay Lake and Neebish channels, St. Marys River, Michigan.
5. St. Clair Flats Canal, Michigan.
6. Operating and care of St. Clair Flats Canal, Michigan.
7. Detroit River, Michigan.
8. Removing sunken vessels or craft obstructing or endangering navigation.

### EXAMINATION AND SURVEY.

9. Back channel in Detroit River from main ship channel to Wyandotte, Mich.

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United States Engineer Office,
*Detroit, Mich., July 20, 1904.*

General: I have the honor to submit herewith the annual report relative to the works under charge of Maj. Wm. H. Bixby, Corps of Engineers, from June 30, 1903, to January 30, 1904, then under charge of Maj. W. L. Fisk, Corps of Engineers, to March 31, 1904, and under my charge since the latter date.

Very respectfully, your obedient servant,

Chas. E. L. B. Davis,
*Lieut. Col., Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## O O 1.

## IMPROVEMENT OF SHIP CHANNEL CONNECTING WATERS OF THE GREAT LAKES BETWEEN CHICAGO, DULUTH, AND BUFFALO.

Operations were in progress during the fiscal year as follows:

*Detroit River and St. Clair River and Lake.*—No dredging was done in the Detroit River under this project during the year. In the St. Clair River 28,806 cubic yards of sand and clay were dredged from the lower approach to the St. Clair Flats Canal in July and August, 1903, under a contract that expired August 25, 1903. From the same locality and from the Arthur House shoal 47,663 cubic yards were dredged under a contract which is still in force. Two dredges have excavated 352,517 cubic yards of material, completing the work at Squirrel Island, St. Clair, Middle Ground, and Stag Island, and at the end of the fiscal year were working at the lower end of Lake Huron, having removed 60,512 cubic yards during the month of June, 1904.

This work is under the local charge of Chief Assistant Engineer E. S. Wheeler.

*St. Marys River.*—At the foot of Little Mud Lake the angle in the channel was widened on the east side by the removal of 49,033 cubic yards of sand and bowlders from an area of about 15,700 square yards and on the west by the removal of 3,941 cubic yards from an area of 2,400 square yards. The bowlders remaining above grade were removed by a steam derrick and a diver, 205 cubic yards of bowlders being picked up.

The angle at Sailors Encampment is to be improved by the removal of bowlders, sand, and rock from an area 1,400 feet long and 200 feet wide on the west side of the channel just above Johnsons Point, and on the east side by the removal of sunken crib and bowlder ridge covering an area of 1,800 square yards. During the year 49,033 cubic yards were dredged on the east side and 3,941 cubic yards on the west side.

In August, 1903, the examination of the river for shoals by means of suspended raft bars was completed. The total area now covered is 30½ square miles between Point Iroquois and Detour, and the location of all shoals and scattered bowlders on which there is less than 27 feet depth of water is now accurately known. Other surveys of special localities were also made during the year.

The St. Marys River work was in charge of Assistant Engineer Joseph Ripley.

*Money statement.*

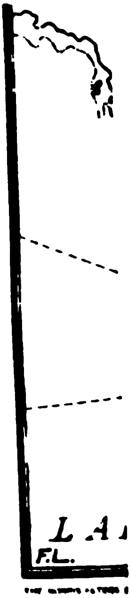
| | |
|---|---|
| July 1, 1903, balance unexpended | $285,579.64 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | [a] 131,337.33 |
| July 1, 1904, balance unexpended | 154,242.31 |
| July 1, 1904, outstanding liabilities | 20,976.12 |
| July 1, 1904, balance available | 133,266.19 |
| July 1, 1904, amount covered by uncompleted contracts | 20,645.36 |

---

[a] The actual expenditures during the year amounted to $131,365.61, from which deductions are made as follows:

| | |
|---|---|
| Amount erroneously charged to this appropriation on account of certificate of settlement No. 22225 | $3.28 |
| Amount received from sale of typewriter September 27, 1902, and heretofore credited to miscellaneous receipts | 25.00 |
| | 28.28 |

**Making the net expenditures $131,337.33.**


L A
F.L.

APPROPRIATIONS.

| | |
|---|---|
| July 13, 1892 | $375,000 |
| March 3, 1893, sundry civil act | 875,000 |
| March 2, 1895, sundry civil act | 500,000 |
| June 11, 1896, sundry civil act | 500,000 |
| June 4, 1897, sundry civil act | 1,090,000 |
| Total | 3,340,000 |

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ABSTRACT OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Emergency contract dated March 30, 1903.*

**Name of contractor:** Hickler Brothers, Sault Ste. Marie, Mich.
**Amount and character of work:** $28,242.85; time work by dredging plant.
**Price per unit:** $15 per working hour.
**Date of beginning of work:** May 1, 1903.
**Date of expiration (as extended):** Indefinite. Completed November 17, 1903.

*Emergency contract dated April 21, 1903.*

**Name of contractor:** The Lake Erie Dredging Company, Buffalo, N. Y.
**Amount and character of work:** $51,220.60; time work by dredging plant.
**Price per unit:** $30 per working hour.
**Date of beginning of work:** May 1, 1903.
**Date of expiration (as extended):** Indefinite. Completed November 17, 1903.

*Contract dated August 12, 1903.*

**Name of contractor:** William E. Rooney, Toledo, Ohio.
**Amount and character of work:** $22,400 (estimated); time work by dredging plant.
**Price per unit:** $14 per working hour in Lake St. Clair; $11.75 per working hour in St. Clair River.
**Date of approval:** August 26, 1903.
**Date of beginning of work:** September 28, 1903.
**Date of expiration:** About November 3, 1904.

*Contract dated August 19, 1903.*

**Name of contractor:** Lake Superior Contracting and Dredging Company, Duluth, Minn.
**Amount and character of work:** $56,800 (estimated); time work by dredging plant.
**Price per unit:** $24 per working hour.
**Date of approval:** September 18, 1903.
**Date of beginning of work:** November 2, 1903.
**Date of expiration:** Indefinite.

*Emergency contract dated September 17, 1903.*

**Name of contractor:** Henry Hickler, Sault Ste. Marie, Mich.
**Amount and character of work:** $3,425.70; hire of derrick boat, tug, etc.
**Price per unit:** Derrick boat, $5.50 per working hour; tug, $2.50 per working hour; dynamite, 20 cents per pound.
**Date of beginning of work:** September 27, 1903.
**Date of expiration:** About December 28, 1903. Completed November 21, 1903.

*Emergency contract dated December [illegible], 1903.*

**Name of contractor:** Walter H. Oades, Detroit, Mich.
**Amount and character of work:** $3,053.42; repairing [illegible] *Hammond*
**Date of beginning of work:** January 2, 1904.
**Date of expiration:** February 15, 1904. Completed February 9, 1904.

*Emergency contract dated April 26, 1904.*

Name of contractor: H. W. Hubbell & Co., Saginaw, Mich.
Amount and character of work: $5,500 (estimated); hire of steam derrick boat, etc.
Price per unit: Derrick boat, $6.15 per working hour; dynamite, 18 cents per pound.
Date of beginning of work: May 6, 1904.
Date of expiration: About August 20, 1904.

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## REPORT OF MR. E. S. WHEELER, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
*Detroit, Mich., July 5, 1904.*

COLONEL: I have the honor to submit the following report of operations under my charge connected with the improvement of the ship channel connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo, for the fiscal year ending June 30, 1904.

The dredge *Gladiator*, owned by M. Sullivan, was employed by the hour in open market, during the months of July and August, and excavated and removed 28,806 cubic yards of sand and clay from the lower approach to St. Clair Flats Canal, Mich., at a total cost of $6,674.60, or 23.1 cents per cubic yard. This dredge stopped work August 25, 1903.

The dredge *S. Birckhead*, owned by the W. E. Rooney estate, was employed for time work under contract dated August 12, 1903, and began work August 27. The work was discontinued for the season November 3, and was resumed again June 7, 1904. During the fiscal year this dredge has excavated and removed 47,663 cubic yards of material from the lower approach to St. Clair Flats Canal and from the "Arthur House" shoal, in the St. Clair River, at a total cost of $7,415.80, or 15.5 cents per cubic yard. This contract is still in force.

The two dredges *Port Huron* and *No. 2*, owned by the Lake Superior Contracting and Dredging Company, were employed for time work under contract dated August 19, 1903, and began work on August 29 and September 10, stopping for the season December 14, 1903. Work was resumed by dredge *No. 2* on May 5, 1904, and by the *Port Huron* on May 16, 1904. During the fiscal year these two dredges have excavated and removed 352,589 cubic yards of material, and have completed the work in accordance with the approved project at Squirrel Island (item M), St. Clair Middle Ground (item L), and Stag Island (item K), at a total cost of $54,281.43, or 15.4 cents per cubic yard. They are now at work on the shoal at the lower end of Lake Huron (item H). This contract is still in force. A partial survey of the shoal at the foot of Lake Huron was made, and 4,950 soundings were taken. Junior Engineer Bamlet Kent has immediate charge of the dredging.

Very respectfully,

E. S. WHEELER,
*Chief Assistant Engineer.*

Lieut. Col. CHARLES E. L. B. DAVIS,
*Corps of Engineers.*

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## REPORT OF MR. JOSEPH RIPLEY, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
*Sault Ste. Marie, Mich., July 1, 1904.*

COLONEL: I have the honor to submit the following report of operations for improving sections 1, 2, 3, and 4 of the 20 and 21 foot channel, connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo, during the fiscal year ending June 30, 1904:

### WIDENING ANGLE AT FOOT OF LITTLE MUD LAKE.

*Section 2, item D.*—Location 21 miles below St. Marys Falls Canal.

Improvement comprises removal of sand and bowlders from a strip 300 feet wide and about 1,200 feet long on east side of channel, and removal of a bowlder ridge about 700 feet long on west bank of channel one-half mile above the angle, to a depth of 21 feet at low-water stage of 578.9.

Under emergency contract dated April 21, 1903, the Lake Erie Dredging Company continued operations with their dredge *Pan American* till August 27, 1903, at rate of $30 per working hour.

On the east side the dredge worked 562.7 hours, was delayed 34.7 hours, and excavated 49,033 cubic yards, scow measurement, from an area of about 15,700 square yards. On the west side the same dredge worked 56.2 hours, was delayed 4.5 hours, and excavated 3,941 cubic yards from an area of 2,400 square yards.

A ridge on the east area, left above grade by the *Pan American* dredge, was removed in October by Hickler Bros. dredge *No. 8*, which excavated 400 cubic yards in 15.3 hours' work.

The bowlders remaining above grade on completion of dredging were removed by steam-derrick boat and diver, employed under emergency contract of September 17, 1903, with Henry Hickler, of Sault Ste. Marie, Mich.

Work was begun September 21, 1903, and the derrick boat worked 160 hours, at $5.50 per hour; the tug 8.9 hours, at $2.50 per hour; and 252 pounds of dynamite used, at 20 cents per pound. Two hundred and five cubic yards of bowlders were picked up. After final examination with the raft bars the two gas buoys were shifted to new positions and the widened channel opened to navigation on October 15, 1903.

Total cost of widening east area, $38,000.95; west area, $1,685, exclusive of engineering and office expenses.

### WIDENING ANGLE AT SAILORS ENCAMPMENT.

*Section 3, item E.*—Location, 22 miles below St. Marys Falls Canal. Improvement comprises removal of bowlders, sand, and limestone rock from an area 200 feet wide and 1,400 feet long from west side of channel, just above Johnsons Point, and removal of sunken crib and bowlder ridge covering an area of 1,800 square yards from east side of channel to a depth of 21 feet at low-water stage of 578.8.

Under emergency contract dated March 30, 1903, with Hickler Bros. for hire of dredge *No. 8*, tug, and 2 dump scows, at rate of $15 per working hour, dredging operations were continued till November 17, 1903.

Hours worked, 1,353.9; delayed, 214; excavation, 34,683 cubic yards, scow measurement, from an area of 8,000 square yards.

Under emergency contract dated April 21, 1903, with the Lake Erie Dredging Company for hire of *Pan American* dredge, tug, and 2 dump scows, at rate of $30 per working hour, the dredge was employed from August 27 to November 17, 1903.

On the west side the working hours were 413.2; the delays by breakages amounted to 321.2 hours, and the excavation to 21,556 cubic yards, scow measurement, from an area of 10,000 square yards. On the east side the working hours numbered 30.7, the delays 0.8, and the excavation 2,166 cubic yards.

Under emergency contract dated September 17, 1903, with Henry Hickler for hire of steam derrick boat and tug at rates of $5.50 per working hour for derrick and $2.50 for tug, the diving outfit worked from September 21 to November 17, 1903, removing bowlders and ridges left above grade by the dredges.

Hours worked 348.9, delayed 37.3, and 815 cubic yards of bowlders and rock picked up. For blasting large bowlders and bed rock, there was used 1,813½ pounds of dynamite, at a cost of 20 cents per pound.

Under emergency contract dated April 26, 1904, with H. W. Hubbell & Co. for steam derrick boat at $6.15 per working hour, the cleaning up was resumed May 9, 1904, and will be completed early in July, when the widened areas will be opened to navigation.

Hours worked, 402.6; delayed 38.7; dynamite used 54 pounds, at 18 cents per pound; and bowlders raised 743 cubic yards.

The total cost of widening west area, $51,230; east area, $920, exclusive of engineering and office expenses.

### SURVEYS.

The examination of St. Marys River for shoals with suspended raft bars was finished in August, when the remaining area of 2½ square miles below Lime Island was swept over. The total area covered between Point Iroquois and Detour was 30½ square miles, and location is accurately known of all shoals and scattered bowlders on which there is less than 27 feet of water.

Examinations were made with bars at 21-foot grade of all areas dredged over during the season, including also the deep-water areas as shown by soundings over 21 feet in Little Mud Lake between Greens Point and upper red gas buoy at the Dark Hole, and at Sailors Encampment on east side of channel opposite Johnsons Point. These areas can not be added to width of navigable channel without removal of numerous bowlders, and quite extensive dredging operations.

In February, 1904, a detail survey, with soundings 10 by 10 feet apart, was made of the river at Sailors Encampment, 49,000 soundings being taken through the ice. The soundings have been reduced and mapped on tracing linen. In March 7,000 soundings were taken on Round Island shoal No. 1, item A1.

Junior Engineer L. P. Morrison was my principal assistant on this work.

Very respectfully, your obedient servant,

JOSEPH RIPLEY,
*Assistant Engineer.*

Lieut. Col. CHAS. E. L. B. DAVIS,
*Corps of Engineers.*

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## O O 2.

## IMPROVEMENT OF ST. MARYS RIVER AT THE FALLS, MICHIGAN.

The work now in progress comprises the construction of movable dam, gate machinery, etc., and the acquisition of water front, covered by the old projects of 1882, 1885, and 1886, and their extensions; also the widening and further improvement provided for by the river and harbor act of June 13, 1902.

The total expenditures up to June 30, 1904, are $4,218,972.52, leaving $544,892.48 available for further payment for outstanding liabilities and further work.

The diversions provided for by the act of June 13, 1902, allowing $20,000 for special work at Sailors Encampment (which was completed during the past fiscal year and included in the above expenditures), and $20,000 for an international commission and about $85,000 for St. Clair Canal work as now estimated will leave only about $439,000 for completion of the 1886 project and for the widening and further improvement above the locks, explained in the June 4, 1900 project (H. Doc. No. 124, 56th Cong., 2d sess.; see p. 3202, annual report 1901).

The unfinished work of the 1886 project will require about $375,000 and the widening, etc., of the 1900 project will require about $1,028,000 (making a total of $1,403,000), so that about $964,000 more is needed for work to be contracted for, and whose commencement has been authorized, but whose completion has not yet been provided for by actual appropriations.

The operations for the past fiscal year were as follows:

The project for widening the canal above the locks to provide a channel between the central pier and the north abutment of the railway swing bridge 108 feet wide, required the inclosure of a portion of the area by a cofferdam so as to permit the excavation to be made in the dry. During the fiscal year about 2,000 feet of this cofferdam has been constructed.

The purchase of land fronting on the river extending from the Weitzel lock to the old Fort Brady Reservation was continued, $148,000 being paid in April, 1904, for 3.4 acres of improved property to Mr. R. D. Perry, and title papers are in process of preparation for the purchase of more land.

Models of the Poe and Weitzel locks were repaired and sent to the Louisiana Purchase Exposition, together with a set of seven large framed views and a bound volume of 74 photographs, while 10,000 copies of the statistical report of canal traffic were also sent as part of the Government exhibit.

Hydrographic surveys, surveys to determine harbor changes, and rock borings were made.

Studies for a movable dam and new lock were made with estimates of the cost of the latter, including the proposed widening of the canal.

The commerce passing through the St. Marys River, shown by the statistics of traffic through both the Canadian and American locks at the Sault for the navigable season of 1903, a period of eight months and fourteen days, was 34,674,437 tons of freight valued at $349,405,014. The number of passengers reported in transit through the locks was 55,175.

Daily readings of water gauges above and below the locks were made throughout the year and their monthly means and differences computed.

Details of operations are given in the appended report of Assistant Engineer Joseph Ripley, under whose immediate supervision the work has been carried on.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $737,068.75 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | [a]192,176.27 |
| July 1, 1904, balance unexpended | 544,892.48 |
| July 1, 1904, outstanding liabilities and diversions of act of June 13, 1902 | 105,613.25 |
| July 1, 1904, balance available | 439,279.23 |
| Amount (estimated) required for completion of existing project | 963,667.42 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement in addition to the balance unexpended July 1, 1904 | 964,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

On past finished projects of 1856 to 1885, $2,875,692, including $10,000 diverted from Great Lakes harbors appropriation of 1864. On present project:

| | | | |
|---|---|---|---|
| August 5, 1886 | $250,000 | August 18, 1894, sundry civil act | $300,000 |
| August 11, 1888 | 1,000,000 | March 2, 1895, sundry civil act | 483,865 |
| September 19, 1890 | 900,000 | | |
| March 3, 1891, sundry civil act | 600,000 | | |
| March 3, 1893, sundry civil act | 1,230,000 | Total | 4,763,865 |

ABSTRACT OF CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Emergency contract dated December 17, 1903.*

Name of contractor: M. Bennett, Sault Ste. Marie, Mich.
Amount and character of work: $1,386; furnishing and delivering clay for cofferdam.
Price per unit: 33 cents per cubic yard.
Date of beginning work: January 26, 1904.
Date of expiration: About March 21, 1904. Completed February 25, 1904.

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[a] This amount includes:

| | |
|---|---|
| Payments by Treasury Department account of— | |
| Michigan Central Railroad Company | $1.63 |
| Duluth, South Shore and Atlantic Railroad Company | 12.15 |
| Amount heretofore erroneously charged to Ship Channel and St. Marys Falls Canal on account of certificate of settlement No. 22225 | 6.56 |
| | 20.34 |

## REPORT OF MR. JOSEPH RIPLEY, ASSISTANT ENGINEER.

United States Engineer Office,
*Sault Ste. Marie, Mich., July 1, 1904.*

Colonel: I have the honor to submit the following report of operations for improving St. Marys River, at the Falls, Michigan, during the fiscal year ending June 30, 1904:

The widening of the canal above the locks as proposed in the June, 1900, project, to provide an additional channel way 108 feet or more in width, to pass between the central pier and north abutment of the railway swing bridge, requires the inclosure of a portion of the area by a cofferdam to permit excavating in the dry. About 2,000 feet of this cofferdam was constructed during the fiscal year by purchasing materials under emergency contracts and performing the work by hired labor. A trench 4 to 6 feet wide and 3 to 20 feet deep was excavated to bed rock and refilled with clay puddled in place. The portion built during the year included that part on the north side of the proposed excavation; and in connection with the 2,500 feet previously built, completes the necessary inclosure of the work. The clay wall will be built up about 3 feet higher after settlement has taken place.

Under emergency contract with M. Bennett, dated December 17, 1903, 4,200 cubic yards of clay were delivered at 33 cents per cubic yard, and 376 cubic yards were afterward purchased in open market at the same rate. The clay was obtained near the west end of Easterday avenue, the average haul being about 1¼ miles.

The plotting of the hydrographic survey of the canal above the lock made in January and February, 1903, was completed.

A hydrographic survey of the lower approach to locks was made in January, 1904. Nine thousand one hundred and fifty-two soundings were taken, 10 by 10 feet apart, through the ice. Only a portion of these soundings have been plotted as yet.

A survey was made to determine changes in the harbor front, and the results plotted.

Borings to rock along the cofferdam trench on south side of proposed canal widening were made. The elevation of rock surface in north trench was noted as the excavation progressed.

Gauges were set, and for six days simultaneous readings of water level were taken at head and foot of each of the five islands in rapids, St. Marys River.

The elevations of gauges at head and foot of canal were checked by levels from established bench marks.

Observations were taken from time to time to determine the changes in length and alignment of the masonry walls of the Poe and Weitzel locks for use in connection with studies for walls of new lock.

The action of the wave formed in the canal by filling the locks was investigated by simultaneous water-gauge readings along the canal pier; also gaugings with current meters were taken at the canal gates, one-half mile above the locks, to determine maximum velocity of the current caused by filling the locks.

Current meters were used to determine velocity of flow through openings in lock floor from culverts while filling the Weitzel lock.

Observations of the time required to fill and empty the Poe lock with 2, 4, and 6 culverts in service were made and the results reduced and report prepared.

The model of the Poe and Weitzel locks made, to scale of one-eighth inch to 1 foot, was repaired, with suitable changes and additions to bring it up to date and then shipped to the Louisiana Purchase Exposition. A set of seven large views, separately framed, and a bound volume of 74 photographs from the series of negatives relating to the work were prepared, and together with 10,000 copies of the statistical report of canal traffic, were forwarded to St. Louis as a part of the Government exhibit at the exposition.

The remainder of the lake survey property stored in canal warehouse was delivered aboard the U. S. S. *Surveyor.*

The self-registering gauges above and below the locks were inspected regularly, the elevations of water surface at hourly intervals scaled from the rolls and recorded, and the rolls sent to the United States lake survey office for file.

Daily readings of staff gauges above and below the locks of the St. Marys Falls Canal, were taken as usual throughout the year. The monthly mean elevations, referred to the system of levels heretofore in use, are as follows:

[Elevation, in feet, above mean tide at New York.]

| Month. | Monthly means. |  | Mean difference. |
|---|---|---|---|
|  | Above locks. | Below locks. |  |
| 1903. | *Feet.* | *Feet.* | *Feet.* |
| July | 602.492 | 582.208 | 20.284 |
| August | 602.691 | 582.343 | 20.348 |
| September | 602.693 | 582.447 | 20.184 |
| October | 602.793 | 582.381 | 20.412 |
| November | 602.583 | 582.076 | 20.507 |
| December | 602.124 | 582.679 | 19.445 |
| 1904. |  |  |  |
| January | 601.693 | 582.915 | 18.778 |
| February | 601.554 | 582.977 | 18.577 |
| March | 601.430 | 582.987 | 18.443 |
| April | 601.620 | 582.450 | 19.170 |
| May | 601.962 | 582.299 | 19.663 |
| June | 602.230 | 582.829 | 19.401 |

The changes in aids to navigation in St. Marys River were specially reported, and related principally to erroneous positions of buoys and to shifting of buoys and float lights in connection with dredging operations of widening and deepening channels.

Suggested changes, so far as concerned St. Marys River, were submitted for use in revision of Bulletin No. 14, Survey of Northern and Northwestern Lakes.

Complaint having been made by adjacent landowner that the old piles in front of the Shine dock and outside the established harbor line were a menace to navigation, correspondence was had with the owner relative to their removal by complainant. As suitable compensation was demanded before the owner would consent to their removal, no further action was taken, as the piles are outside the limits of approved channel 1,000 feet wide.

Negotiations were continued for purchase by the United States of lands located between St. Marys River and Water street and extending from the Weitzel lock to the old Fort Brady Reservation. Written offers, stating definite terms of sale, were received from all the owners excepting three. Special boards of three experts each were appointed to appraise the different lots. Purchase of six properties, containing about 5½ acres, at the appraisal values was authorized by the War Department. Payment of $148,000 was made in April, 1904, to Robert D. Perry, for 3.4 acres of improved property, including dock and buildings. Title papers are being prepared for 2.2 acres, at valuation of $122,600. This leaves a tract of 2 acres, the purchase of which has not been provided for.

Studies for movable dam were continued and special reports submitted covering the twenty types that have been considered.

Studies for new lock were continued, and designs with drawings were made of steel gate, of floor system of concrete-steel construction with culverts underneath, and of concrete walls inclosing filling culverts. Estimate of cost of a new lock, including the proposed widening of canal, was prepared.

Assistant Engineer L. C. Sabin had special charge of this part of the work.

Very respectfully, your obedient servant,

Joseph Ripley,
*Assistant Engineer.*

Lieut. Col. Chas. E. L. B. Davis,
*Corps of Engineers.*

## O O 3.

### OPERATING AND CARE ST. MARYS FALLS CANAL.

This service is provided for from the permanent indefinite appropriation for operating and care of canals and other works of navigation under section 4 of the river and harbor act of July 5, 1884.

The progress of improvement of this waterway is explained under the heading of the improvement of St. Marys River at the Falls. (See Appendix O O 2.)

During the fiscal year the canal was open to navigation 225 days, the closed period of 141 days being from December 15, 1903, to May 5, 1904. During this open period there passed through the canal 21,889,058 tons of freight, a decrease of 9,739,307 tons over the tonnage for the fiscal year of 1903. Most of this decrease occurred this spring, viz, 8,354,778 tons, from the opening of navigation to June 30, 1904, and was partly owing to the late opening of navigation, but principally to the strike of the Masters and Pilots Association, which was in force from the opening of navigation to June 13, 1904.

The total delays that occurred in locking vessels during the year amounted to thirty-seven hours, of which thirty-five occurred at the Poe lock and the remaining two at the Weitzel lock.

Many minor accidents, resulting in damage to property, occurred and one of the linemen had his hand crushed while placing cable on snubbing post.

Extensive repairs were made to operating machinery, the old valve engines being removed and ten new 12-inch valve engines installed, while many minor repairs were made to various parts of the two locks and approaches.

The report of Mr. Joseph Ripley, assistant engineer and general superintendent of the canal, is submitted herewith, to which attention is invited for details of service, repairs, accidents, etc.

The very complete statistics of lake commerce passing through the American and Canadian canals during the season of 1903, compiled from the official records at the St. Marys Falls Canal, are also appended.

The estimated amount required for the year ending June 30, 1905, is $94,000, to be applied approximately as follows: For pay rolls, $69,400; for repairs, $11,600; for general supplies, $7,000; for electric lighting of buildings, locks, and grounds, $3,000, and for general contingencies, including office expenses, $3,000.

*Summary of expenses for operating and care of St. Marys Falls Canal, Michigan, for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Pay rolls | $70,914.10 |
| Repair material | 10,359.26 |
| General supplies | 7,177.49 |
| Electric lighting | 2,670.00 |
| Contingencies | 2,127.62 |
| Total | 93,248.47 |

### *Money statement.*

| | | | |
|---|---|---|---|
| Expenses to June 30, 1903 | | | $1,133,303.72 |
| Outstanding liabilities to June 30, 1903 | | | 7,040.42 |
| Total expenses to June 30, 1903 | | | 1,140,344.14 |
| Expended during fiscal year ending June 30, 1904 | | $93,065.15 | |
| Deduct outstanding liabilities pertaining to preceding year | $7,040.42 | | |
| Deduct amount erroneously charged to this allotment, account settlement made by Treasury Department with Duluth, South Shore and Atlantic Railway Company | 3.28 | | |
| | | 7,043.70 | |
| | | 86,021.45 | |
| Add outstanding liabilities June 30, 1904 | 7,210.82 | | |
| Add amount of proceeds of condemned Government property erroneously credited to this allotment | 16.20 | | |
| | | 7,227.02 | |
| | | | 93,248.47 |
| Total expenses to June 30, 1904 (including outstanding liabilities) | | | 1,233,592.61 |

### *Estimate.*

| | |
|---|---|
| Amount (estimated) for fiscal year ending June 30, 1905 | $94,000.00 |
| Balance from allotment for preceding year (in round numbers) | 20,000.00 |
| Additional allotment required for fiscal year ending June 30, 1905 | 74,000.00 |

### *Expenses for operating and care of St. Marys Falls Canal, Michigan.*

| | |
|---|---|
| 1882 | $31,207.48 |
| 1883 | 35,509.70 |
| 1884 | 31,212.93 |
| 1885 | 27,242.45 |
| 1886 | 25,400.95 |
| 1887 | 22,138.92 |
| 1888 | 29,898.72 |
| 1889 | 30,749.45 |
| 1890 | 34,323.85 |
| 1891 | 48,330.89 |
| 1892 | 61,389.74 |
| 1893 | 42,412.12 |
| 1894 | 55,213.09 |
| 1895 | $50,908.67 |
| 1896 | 60,763.28 |
| 1897 | 78,104.05 |
| 1898 | 58,890.72 |
| 1899 | 90,307.94 |
| 1900 | 79,293.26 |
| 1901 | 75,475.33 |
| 1902 | 87,693.80 |
| 1903 | 83,876.80 |
| 1904 | 93,248.47 |
| Total | 1,233,592.61 |

### *Statement of receipts and expenses for fiscal year ending June 30, 1904.*

| | |
|---|---|
| Receipts: | |
| Balance at close of fiscal year ending June 30, 1903 (including outstanding liabilities) | $26,677.01 |
| July 18, 1903, allotment | 87,000.00 |
| | 113,677.01 |
| Expenses | 93,248.47 |
| Balance at close of fiscal year ending June 30, 1904 | 20,428.54 |

ABSTRACT OF CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Emergency contract dated August 26, 1903.*

Name of contractor: Vulcan Iron Works, Chicago, Ill.
Amount and character of work: $6,856; furnishing 10 valve engines for Poe lock.
Price per unit: Four at $679 each, and 6 at $690 each.
Date of beginning work: September 5, 1903.
Date of expiration: December 31, 1903.

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## COMMERCIAL STATISTICS.

### *Statistics of lake commerce passing through the American and Canadian canals at Sault Ste. Marie, Michigan and Ontario, during the season of 1903.*

[Compiled from official records at St. Marys Falls Canal, Michigan.]

### SOURCES OF INFORMATION FOR TRAFFIC DATA AND VALUATIONS.

*Freight tonnage and passengers.*—The freight unit used and designated as a "net ton" means in every instance a ton of 2,000 pounds. The data relative to freight and passengers were compiled from reports made by vessel masters when passing through the American and Canadian canals. As a daily exchange of these reports is made with Supt. J. C. Boyd of the Canadian Canal, both offices have record of the entire lake traffic to and from Lake Superior.

*Registered tonnage and vessel valuations.*—The registered tonnage, as given, was obtained from vessel papers and blue books. Vessel valuations were obtained from Inland Lloyd's.

*Freight rates.*—These were compiled from quotations published in the Marine Review, and from information obtained from shippers, owners, and carriers of the several classes of freight. The freight rates given are for lake transportation and include cost of loading and unloading.

*Freight valuations.*—The unit values used for the various items of freight were derived by taking the mean for the season of each monthly average as obtained from daily or weekly prices current.

The sources of the valuations given are as follows: Coal, quotations in Coal Trade Journal at Duluth and Superior; cereals, Daily Commercial Record, published by Duluth Board of Trade; flour, daily quotations in Duluth, Superior, and Minneapolis journals; iron ore and pig iron, weekly quotations in Iron Trade Review, Marine Review; salt, quotations at Lake Superior ports; copper, general merchandise, lumber, building stone, and manufactured iron, quotations by the principal shippers, owners, and carriers.

To quotations given at point of shipment, freight rates are added to lake ports of destination.

The compilation was done by the clerical force in the United States canal office at Sault Ste. Marie, Mich., under the general direction of General Superintendent Joseph Ripley.

*American and Canadian canals.*—The total freight traffic of 34,674,437 net tons for the season of 1903, when compared with season of 1902, the maximum in the history of the canals, shows a decrease of 4 per cent, or 1,286,709 tons; but in comparison with the previous maximum year, that of 1901, this year's traffic shows a gain of 6,271,372 tons, or 22 per cent.

The items showing an increase are coal, grain, and salt. The falling off in the movement of iron ore largely accounts for decrease in total traffic.

The total number of passengers was 55,175; a decrease of 4,202, or 7 per cent.

Vessel passages through both canals numbered 18,596, showing a loss of 4,063 passages, or 18 per cent, as compared with the 22,659 passages of 1902. The total lockages numbered 11,642, showing a loss of 1,204 lockages, or 9 per cent.

The season of navigation continued for a period of 8 months and 14 days, during which time the average monthly traffic was 4,095,406 tons.

*American canal.*—The traffic through the American canal was 84 per cent of the total freight and 42 per cent of the passengers carried, the amounts being 29,172,252 tons of freight and 23,156 passengers. Compared with the season of 1902 there was a decrease of 2,060,543 tons of freight, or 7 per cent, and an increase of 378 passengers, or 2 per cent.

The American canal opened April 11 and closed December 15, 1903, making the length of its season 249 days.

*Canadian canal.*—The traffic through the Canadian canal was 16 per cent of the total freight and 58 per cent of the passengers carried, the amounts being 5,502,185 tons of freight and 32,019 passengers. Compared with the season of 1902 there was an increase of 773,834 tons, or 16 per cent, and a decrease of 4,580 passengers, or 13 per cent.

The Canadian canal was opened April 2 and closed December 13, 1903, making the length of its season 256 days.

The depth of water in entrance channels and through the canals and locks permitted a safe draft of 17½ to 19½ feet.

The growth of the Lake Superior commerce during the past half century has been phenomenal. The estimated amount and value of articles which crossed the portage at Saulte Ste. Marie in 1851, to and from Lake Superior, was 12,600 net tons, valued at $1,675,000.

In 1861, a decade later, the traffic through the State locks was 88,000 net tons, valued at $6,000,000.

In 1871, 585,000 net tons, valued at $13,000,000.

In 1881, through the State and Weitzel locks, 1,567,741 net tons, valued at $30,000,000.

In 1891, through Weitzel lock, 8,888,759 net tons, valued at $128,178,208.

In 1901, through Weitzel, Poe, and Canadian locks, 28,403,065 net tons, valued at $289,906,865.

Thus the percentage of increase in tonnage of each year's traffic over that of the preceding year has averaged as follows:

| | Per cent. |
|---|---|
| 1851-1860 | 21 |
| 1861-1870 | 21 |
| 1871-1880 | 10½ |
| 1881-1890 | 19 |
| 1891-1900 | 12¼ |
| Average, 1851-1900 | 16¾ |

*East and west bound commerce passing both American and Canadian canals at Sault Ste. Marie, Mich. and Ontario, for the season of 1903.*

EAST BOUND

| Articles. | | United States canal. | Canadian canal. | Total. |
|---|---|---|---|---|
| Copper | net tons | 96,859 | 17,018 | 112,877 |
| Grain | bushels | 25,987,494 | 6,103,654 | 32,091,148 |
| Building stone | net tons | 21,300 | ............ | 21,300 |
| Flour | barrels | 4,319,801 | 2,773,444 | 7,093,245 |
| Iron ore | net tons | 18,978,425 | 2,676,473 | 21,654,898 |
| Iron, pig | do | 9,717 | 16,405 | 26,122 |
| Lumber | M ft. B. M. | 957,850 | 45,342 | 1,003,192 |
| Wheat | bushels | 29,181,901 | 32,202,651 | 61,384,552 |
| General merchandise | net tons | 49,046 | 43,440 | 92,486 |
| Passengers | number | 8,695 | 19,580 | 28,275 |

WEST BOUND.

| Articles. | | United States canal. | Canadian canal. | Total. |
|---|---|---|---|---|
| Coal: | | | | |
| Hard | net tons | 1,033,935 | 115,070 | 1,149,005 |
| Soft | do | 4,918,176 | 870,452 | 5,788,628 |
| Flour | barrels | 20 | 115 | 135 |
| Grain | bushels | 2,738 | 1,760 | 4,498 |
| Manufactured iron | net tons | 111,941 | 55,204 | 167,145 |
| Salt | barrels | 313,491 | 141,391 | 454,882 |
| General merchandise | net tons | 380,075 | 187,278 | 567,353 |
| Passengers | number | 14,461 | 12,439 | 26,900 |
| Freight: | | | | |
| East bound | net tons | 22,684,943 | 4,247,295 | 26,932,238 |
| West bound | do | 6,487,309 | 1,254,890 | 7,742,199 |
| Total freight | do | 29,172,252 | 5,502,185 | 34,674,437 |
| Vessel passages | number | 14,243 | 4,353 | 18,596 |
| Registered tonnage | net | 22,998,864 | 4,737,580 | 27,736,444 |

*Distribution of the foregoing freight tonnage, by calendar months, during season of 1903.*

| Month. | East bound. | West bound. | Total freight. |
|---|---|---|---|
| | *Net tons.* | *Net tons.* | *Net tons.* |
| April | 1,013,520 | 638,319 | 1,651,839 |
| May | 4,062,487 | 1,125,530 | 5,188,017 |
| June | 3,967,071 | 1,138,007 | 5,105,078 |
| July | 4,281,536 | 997,892 | 5,279,428 |
| August | 4,241,683 | 1,162,125 | 5,403,808 |
| September | 3,252,058 | 1,013,592 | 4,265,650 |
| October | 3,656,200 | 819,765 | 4,475,965 |
| November | 2,062,656 | 744,798 | 2,807,454 |
| December | 395,027 | 102,171 | 497,198 |
| Total | 26,932,238 | 7,742,199 | 34,674,437 |

*Freight to and from each lake.*

[Classified with reference to American and Canadian vessels and ports.]

| | Port of departure. | Port of destination. | East bound from Lake Superior to— | | | | Total. |
|---|---|---|---|---|---|---|---|
| | | | Lake Michigan. | Lake Huron. | Lake Erie. | Lake Ontario. | |
| Freight carried by— | | | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| American vessels | American | American | 3,210,674 | 140,065 | 21,753,021 | 83,655 | 25,187,415 |
| Do | do | Canadian | | 55,992 | 9,416 | 53,850 | 119,258 |
| Do | Canadian | American | | 27,063 | 187,126 | 1,890 | 216,079 |
| Canadian vessels | do | Canadian | | 776,454 | | 178,998 | 955,452 |
| Do | do | American | | 1,134 | 262,614 | | 263,748 |
| Do | American | Canadian | | 154,669 | | 85,617 | 190,286 |
| Total east bound | | | 3,210,674 | 1,155,377 | 22,212,177 | 354,010 | 26,932,238 |

| | Port of departure. | Port of destination. | West bound to Lake Superior from— | | | | Total. |
|---|---|---|---|---|---|---|---|
| | | | Lake Michigan. | Lake Huron. | Lake Erie. | Lake Ontario. | |
| Freight carried by— | | | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| American vessels | American | American | 81,922 | 49,410 | 6,430,467 | 23,501 | 6,585,300 |
| Do | do | Canadian | | 236 | | 1,700 | 1,936 |
| Do | Canadian | American | 8,109 | 1,946 | 641,358 | 1,954 | 653,367 |
| Canadian vessels | do | Canadian | | 138,626 | 765 | 67,144 | 206,535 |
| Do | do | American | | | 257,137 | 2,095 | 259,232 |
| Do | American | Canadian | | 35,829 | | | 35,829 |
| Total west bound | | | 90,031 | 226,047 | 7,329,727 | 96,394 | 7,742,199 |
| Grand total | | | 3,300,705 | 1,381,424 | 29,541,904 | 450,404 | 34,674,437 |

*Estimated value of total freight passing both American and Canadian canals at Sault Ste. Marie, Mich. and Ontario, for the season of 1903.*

| Items. | | Quantity. | Price per unit. | Valuation. |
|---|---|---|---|---|
| Coal: | | | | |
| Anthracite | net tons | 1,119,005 | $5.80 | $6,664,229 |
| Bituminous | do | 5,788,628 | 3.15 | 18,234,178 |
| Flour | barrels | 7,093,380 | 4.50 | 31,920,210 |
| Wheat | bushels | 61,384,552 | .80 | 49,107,642 |
| Grain, other than wheat | do | 82,095,646 | .71 | 22,787,909 |
| Manufactured iron | net tons | 167,145 | 110.00 | 18,385,950 |
| Pig iron | do | 26,122 | 20.00 | 522,440 |
| Salt | barrels | 454,882 | .70 | 318,417 |
| Copper (refined and matte) | net tons | 112,877 | 230.00 | 25,961,710 |
| Iron ore | do | 21,654,898 | 3.45 | 74,709,398 |
| Lumber | M feet B. M. | 1,003,192 | 18.00 | 18,057,456 |
| Building stone | net tons | 21,300 | 12.00 | 255,600 |
| General merchandise | do | 659,839 | 125.00 | 82,479,875 |
| Total | | | | 349,405,014 |

The value of grain, other than wheat, as given in the above table, is computed as follows:

| Articles. | Bushels. | Price per unit. | Total value. |
|---|---|---|---|
| Rye | 1,007,106 | $0.55 | $553,908.30 |
| Oats | 9,214,833 | .36 | 3,317,339.88 |
| Corn | 72,000 | .55 | 39,600.00 |
| Barley | 6,325,351 | .47 | 2,972,914.97 |
| Flax | 15,476,356 | 1.027 | 15,894,217.61 |
| Total | 32,095,646 | [a].71 | 22,777,980.76 |

[a] Average.

*Relative monetary values of freight.*

| | Per cent. |
|---|---|
| Coal (anthracite and bituminous) | 7.12 |
| Cereals (wheat, rye, oats, corn, barley, flax, and flour) | 29.71 |
| Iron (iron ore, manufactured and pig iron) | 26.80 |
| Copper | 7.43 |
| Lumber | 5.17 |
| All other products | 23.77 |
| Total | 100.00 |

*Freight charges upon freight transported through both American and Canadian canals at Sault Ste. Marie, Mich. and Ontario, for the season of 1903.*

| Articles. | | Quantity. | Rate per unit. | Amount. |
|---|---|---|---|---|
| Coal | net tons | 6,937,633 | $0.53 | $3,676,945.49 |
| Flour | barrels | 7,093,380 | .12 | 851,205.60 |
| Wheat | bushels | 61,384,552 | .016 | 982,152.83 |
| Grain, other than wheat | do | 32,095,646 | .016 | 513,530.34 |
| Manufactured iron | net tons | 167,145 | 2.00 | 334,290.00 |
| Pig iron | do | 26,122 | 1.50 | 39,183.00 |
| Salt | barrels | 454,882 | .15 | 68,232.30 |
| Copper | net tons | 112,877 | 1.43 | 161,414.11 |
| Iron ore | do | 21,654,898 | .75 | 16,241,173.50 |
| Lumber | M feet B. M. | 1,003,192 | 2.50 | 2,507,980.00 |
| Building stone | net tons | 21,300 | 1.50 | 31,950.00 |
| General merchandise | do | 659,839 | 2.00 | 1,319,678.00 |
| Total | | | | 26,727,735.17 |

*Classification of American and Canadian vessels, showing valuation, and the tonnage and passengers carried by each of them through both the American and Canadian canals at Sault Ste. Marie, Michigan and Ontario, during season of 1903.*

AMERICAN VESSELS.

| Class. | Number. | Valuation. | Tonnage. | | Passengers. |
|---|---|---|---|---|---|
| | | | Registered. | Freight (net tons). | |
| Steamers | 566 | $60,007,000 | 896,395 | 26,339,526 | 19,558 |
| Sailing | 233 | 8,245,800 | 255,859 | 6,412,457 | |
| Unregistered | | | | 11,373 | |
| Total | 799 | 68,252,800 | 1,152,254 | 32,763,356 | 19,558 |

CANADIAN VESSELS.

| Class. | Number. | Valuation. | Registered. | Freight (net tons). | Passengers. |
|---|---|---|---|---|---|
| Steamers | 86 | $5,977,500 | 59,874 | 1,703,021 | 35,617 |
| Sailing | 10 | 407,000 | 11,070 | 181,847 | |
| Unregistered | | | | 26,214 | |
| Total | 96 | 6,384,500 | 70,944 | 1,911,082 | 35,617 |

American vessels carried 94 per cent of the total freight and 35 per cent of the total passengers.

Canadian vessels carried 6 per cent of the total freight and 65 per cent of the total passengers.

Unregistered American crafts carried 11,373 net tons of freight in 232 passages, or an average of $49\frac{43}{2000}$ tons per passage.

Unregistered Canadian crafts carried 26,214 net tons of freight in 129 passages, or an average of $203\frac{419}{2000}$ tons per passage.

Of the 18,596 passages for the season, 2,461 were by 84 vessels under 100 tons register, with an average register of 36 tons. The total freight carried by such craft amounted to 2,083 net tons.

*Classification of registered vessels as to length and beam over all, 1899–1903.*

| Length. | Beam. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|
| 30 to 100 feet | 5 to 21 feet | 109 | 82 | 85 | 84 | 82 |
| 100 to 200 feet | 21 to 39 feet | 289 | 320 | 282 | 248 | 227 |
| 200 to 300 feet | 32 to 43 feet | 267 | 285 | 303 | 337 | 314 |
| 300 to 400 feet | 38 to 50 feet | 126 | 136 | 152 | 179 | 175 |
| 400 to 500 feet | 45 to 53 feet | 41 | 56 | 71 | 87 | 97 |
| Total |  | 832 | 879 | 893 | 935 | 895 |

*Average and maximum dimensions of, and percentage of total freight carried by, vessels of different classes.*

| Class. | Steamers. |  |  |  |  |  | Sailing vessels. |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  | Number using canal. | Aggregate registered tonnage. | Average registered tonnage. | Average length. | Maximum length. | Maximum beam. | Number of passages of vessels. | Aggregate freight carried. | Average cargo. | Percentage of total freight carried. |
| Tons net register between— |  | *Tons.* | *Tons.* | *Feet.* | *Feet.* | *Feet.* |  | *Net tons.* | *Net tons.* |  |
| 1 and 1,000 | 445 | 204,050 | 459 | 167.8 | 285 | 42.0 | 7,197 | 3,840,989 | 534 | 11.1 |
| 1,000 and 2,000 | 247 | 373,108 | 1,511 | 284.5 | 374 | [a]45.5 | 4,919 | 10,169,523 | 2,067 | 29.3 |
| 2,000 and 3,000 | 79 | 205,745 | 2,604 | 363.8 | 433 | 51.5 | 1,943 | 6,564,263 | 3,378 | 19.0 |
| 3,000 and 4,000 | 105 | 356,941 | 3,399 | 422.0 | 478 | 53.0 | 2,908 | 11,724,314 | 4,032 | 33.8 |
| 4,000 and 5,000 | 19 | 83,354 | 4,387 | 465.8 | 498 | 53.0 | 550 | 2,337,761 | 4,250 | 6.7 |
| Unregistered |  |  |  |  |  |  | 1,079 | 37,587 | 35 | .1 |
| Total | 895 | 1,223,198 |  |  |  |  | 18,596 | 34,674,437 |  | 100.0 |

[a] Exclusive of steamer *City of Mackinac*, beam 69.2 feet.

*Yearly change in class of freighters as listed from their maximum freight cargoes.*

|  | 1893. | 1894. | 1895. | 1896. | 1897. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Boats carrying between— |  |  |  |  |  |  |  |  |  |  |  |
| 2,000 and 3,000 net tons | 154 | 192 | 176 | 168 | 133 | 116 | 109 | 117 | 112 | 112 | 89 |
| 3,000 and 4,000 net tons | 15 | 18 | 18 | 43 | 111 | 118 | 139 | 125 | 149 | 159 | 162 |
| 4,000 and 5,000 net tons |  |  | 4 | 21 | 26 | 26 | 22 | 23 | 30 | 38 | 36 |
| 5,000 and 6,000 net tons |  |  |  | 11 | 28 | 34 | 32 | 36 | 41 | 39 | 41 |
| 6,000 and 7,000 net tons |  |  |  |  | 8 | 18 | 27 | 25 | 33 | 54 | 63 |
| 7,000 and 8,000 net tons |  |  |  |  |  | 5 | 10 | 23 | 33 | 45 | 54 |
| 8,000 and over net tons |  |  |  |  |  |  | 5 | 8 | 10 | 11 | 19 |

The 50 new vessels put in commission for the Lake Superior trade were large steam freighters, ranging from 200 to 468 feet in length, and designed for economical speed of 12 miles per hour on a draft of 19 to 21 feet.

*Maximum cargo records.*

| Class. | Number. | Maximum tonnage for one trip each. | |
|---|---|---|---|
| | | Aggregate. | Average. |
| Steamers carrying over— | | *Net tons.* | *Net tons.* |
| 2,000 net tons | 71 | 178,705 | 2,517 |
| 3,000 net tons | 136 | 470,586 | 3,460 |
| 4,000 net tons | 24 | 111,545 | 4,648 |
| 5,000 net tons | 37 | 213,565 | 5,773 |
| 6,000 net tons | 42 | 281,485 | 6,702 |
| 7,000 net tons | 52 | 397,787 | 7,649 |
| 8,000 net tons | 13 | 108,346 | 8,334 |
| Sailing vessels carrying over— | | | |
| 2,000 net tons | 18 | 40,481 | 2,249 |
| 3,000 net tons | 26 | 87,481 | 3,365 |
| 4,000 net tons | 12 | 54,494 | 4,541 |
| 5,000 net tons | 4 | 21,900 | 5,475 |
| 6,000 net tons | 21 | 133,765 | 6,370 |
| 7,000 net tons | 2 | 14,821 | 7,410 |
| 8,000 net tons | 6 | 50,607 | 8,435 |
| Total | 464 | 2,165,538 | ......... |

The above table shows that 464 different vessels in a single trip of each carried a total of 2,165,538 net tons.

*Individual maximum records made by vessels during the season.*

| Name of vessel. | Maximum. | Amount. | Owners. |
|---|---|---|---|
| Steamer Wm. Edenborn | Single cargo, net tons | 8,914 | Pittsburg Steamship Co. |
| Barge Manila | do | 8,671 | Do. |
| Steamer John W. Gates | Total cargoes, net tons | 164,763 | Do. |
| Steamer Buffalo | Miles run | 45,380 | New York Central and Hudson River R. R. Co. |
| Steamer Bransford | Mile-tons | 158,848,973 | Hawgood Transportation Co., of Cleveland, Ohio. |

The maximum traffic for a single day was on August 31, when 295,782 freight tons passed through the canals on 151 vessels, having an aggregate registered tonnage of 211,426 tons.

The minimum traffic was on April 2, when 2 vessels registering 60 tons passed through the canals carrying no freight. There were no lockages on April 3 and 7.

### *Delays.*

The American canal records show that vessels necessarily spent 19,970 hours and 32 minutes in canal or an average of 1 hour 24 minutes and 8 seconds, which includes time waiting for lockage and passage through locks and canal, the latter being 1¾ miles long.

Other delays at canal, which included taking on supplies, waiting for daylight or favorable weather, amounted to 13,588 hours and 47 minutes.

Other delays to boats due to operating railway swing bridge amounted to 2 minutes.

Trains were delayed 2 hours and 55 minutes by passing boats, temporarily preventing the closing of bridge.

*General summary—For American and Canadian canals together.*

| | | |
|---|---|---|
| Total | mile-tons.. | 28,974,660,408 |
| Total freight carried | tons.. | 34,674,437 |
| Total valuation placed on freight carried | | $349,405,014 |
| Average value per ton of freight carried | | $10.08 |
| Total amount paid for freight transportation | | $26,727,735.17 |
| Average distance freight was carried | miles.. | 835.6 |
| Cost per mile per ton | mills.. | .92 |

| | |
|---|---|
| Average cost per ton for freight transportation | $0.77 |
| Total number of registered vessels using canals | 895 |
| Total number of passages by unregistered crafts carrying freight | 361 |
| Time American canal was operated ...days | 249 |
| Time Canadian canal was operated ...do | 256 |
| Total valuation placed on registered vessels | $74,637,300 |
| Total number of passengers transported | 55,175 |
| Freight carried by— | |
| Registered vessels ...tons | 34,636,850 |
| Unregistered vessels ...do | 37,587 |
| American vessels ...per cent | 94 |
| Canadian vessels ...do | 6 |
| Passengers carried by— | |
| American vessels ...do | 35 |
| Canadian vessels ...do | 65 |

### *Canal post-office.*

The American canal post-office delivered 146,775 pieces of mail during the season, consisting of 128,996 letters, 5,736 postals, 11,204 newspapers, and 839 parcels; also returned 727 pieces to the city post-office after being held thirty days uncalled for, and forwarded 4,846 pieces to new addresses. As compared with last year, this shows a decrease of 15,909 pieces of mail. The carrying, distributing and delivering of marine mail was done by the office employees in addition to their regular duties of receiving masters' reports and keeping the traffic records.

### *Comparative traffic—Years 1902 and 1903.*

Lake commerce through both the American and Canadian canals at Sault Ste. Marie, Michigan and Ontario for the seasons of 1902 and 1903:

| Items. | Traffic for 1903. | | Total traffic for— | | Gain, 1903. | | Loss, 1903. | |
|---|---|---|---|---|---|---|---|---|
| | United States canal. | Canadian canal. | Season 1903. | Season 1902. | Amount. | Per cent. | Amount. | Per cent. |
| Vessel passages: | | | | | | | | |
| Steamers ...No. | 10,138 | 3,889 | 14,027 | 17,069 | ........ | ..... | 3,042 | 18 |
| Sailing ...do | 3,272 | 297 | 3,569 | 4,368 | ........ | ..... | 799 | 18 |
| Unregistered ...do | 833 | 167 | 1,000 | 1,222 | ........ | ..... | 222 | 18 |
| Total ...do | 14,243 | 4,853 | 18,596 | 22,659 | ........ | ..... | 4,063 | 18 |
| Lockages ...do | 8,395 | 3,247 | 11,642 | 12,846 | ........ | ..... | 1,204 | 9 |
| Tonnage: | | | | | | | | |
| Registered ...net | 22,998,864 | 4,737,580 | 27,736,444 | 31,955,582 | ........ | ..... | 4,219,138 | 13 |
| Freight ...net tons | 29,172,252 | 5,502,185 | 34,674,437 | 35,961,146 | ........ | ..... | 1,286,709 | 4 |
| Passengers ...No. | 23,156 | 32,019 | 55,175 | 59,377 | ........ | ..... | 4,202 | 7 |
| Coal: | | | | | | | | |
| Hard ...net tons | 1,033,935 | 115,070 | 1,149,005 | 309,948 | 839,057 | 271 | ........ | ..... |
| Soft ...do | 4,918,176 | 870,452 | 5,788,628 | 4,502,580 | 1,286,098 | 29 | ........ | ..... |
| Flour ...barrels | 4,319,821 | 2,773,559 | 7,093,380 | 8,910,240 | ........ | ..... | 1,816,860 | 20 |
| Wheat ...bushels | 29,181,901 | 32,202,651 | 61,384,552 | 76,730,965 | ........ | ..... | 15,346,413 | 20 |
| Grain, other than wheat, bushels | 25,990,232 | 6,105,414 | 32,095,646 | 27,740,822 | 4,354,824 | 16 | ........ | ..... |
| Manufactured and pig iron, net tons | 121,658 | 71,609 | 193,267 | 198,152 | ........ | ..... | 4,885 | 2 |
| Salt ...barrels | 313,491 | 141,391 | 454,882 | 443,306 | 11,576 | 3 | ........ | ..... |
| Copper ...net tons | 95,859 | 17,018 | 112,877 | 120,612 | ........ | ..... | 7,735 | 6 |
| Iron ore ...do | 18,978,425 | 2,676,473 | 21,654,898 | 24,277,555 | ........ | ..... | 2,622,657 | 11 |
| Lumber ...M. feet B. M. | 957,850 | 45,342 | 1,003,192 | 1,091,471 | ........ | ..... | 88,279 | 8 |
| Silver ore ...net tons | ........ | ........ | ........ | 1 | ........ | ..... | 1 | 100 |
| Building stone ...do | 21,300 | ........ | 21,300 | 38,919 | ........ | ..... | 17,619 | 45 |
| General merchandise ...do | 429,121 | 230,718 | 659,839 | 740,100 | ........ | ..... | 80,261 | 11 |

### *Comparative yearly summaries since 1887.*

**Total freight, its valuation, freight charges, average haul or distance freight was carried, and rate per ton per mile.**

| Year. | Total freight. | Valuation of freight. | Freight charges. | Average haul. | Freight charges, per mile-ton. | Value of American craft. | Value of Canadian craft. |
|---|---|---|---|---|---|---|---|
| | *Net tons.* | | | *Miles.* | *Mills.* | | |
| 1887 | 5,494,649 | $79,031,757 | $10,075,153 | 811.4 | 2.3 | $17,684,550 | $2,089,400 |
| 1888 | 6,411,423 | 82,156,019 | 7,883,077 | 806.4 | 1.5 | 20,381,100 | 1,514,300 |
| 1889 | 7,516,022 | 83,732,527 | 8,634,246 | 790.4 | 1.5 | 25,328,600 | 1,597,600 |
| 1890 | 9,041,213 | 102,214,948 | 9,472,214 | 797.2 | 1.3 | 27,857,700 | 1,777,800 |
| 1891 | 8,888,759 | 128,178,208 | 9,849,022 | 820.4 | 1.35 | 31,947,300 | 2,119,500 |
| 1892 | 11,214,333 | 135,117,267 | 12,072,850 | 822.4 | 1.31 | 36,220,100 | 2,108,700 |
| 1893 | 10,796,572 | 145,436,957 | 9,957,483 | 831.9 | 1.1 | 39,017,400 | 2,115,700 |
| 1894 | 13,195,860 | 143,114,502 | 10,798,310 | 821.1 | .99 | 41,124,200 | 1,959,800 |
| 1895 | 15,062,580 | 159,575,129 | 14,238,758 | 830.0 | 1.14 | 40,858,800 | 2,037,000 |
| 1896 | 16,239,061 | 195,146,842 | 13,511,615 | 836.4 | .99 | 43,006,200 | 2,135,300 |
| 1897 | 18,982,755 | 218,235,927 | 13,220,099 | 841.3 | .83 | 42,375,700 | 2,001,400 |
| 1898 | 21,234,664 | 233,069,740 | 14,125,896 | 842.6 | .79 | 45,199,800 | 2,491,900 |
| 1899 | 25,255,810 | 281,364,750 | 21,959,707 | 827.2 | 1.05 | 65,000,520 | 3,369,600 |
| 1900 | 25,643,073 | 267,041,959 | 24,953,314 | 825.9 | 1.18 | 66,116,583 | 3,618,576 |
| 1901 | 28,403,065 | 289,906,865 | 23,217,974 | 823.3 | .99 | 57,244,200 | 3,311,900 |
| 1902 | 35,961,146 | 358,306,300 | 26,566,189 | 827.4 | .89 | 67,205,000 | 3,792,400 |
| 1903 | 34,674,437 | 349,405,014 | 26,727,735 | 835.6 | .92 | 68,252,800 | 6,384,500 |

### *Freight rates for water transportation to and from Lake Superior.*

| Items. | 1887. | 1888. | 1889. | 1890. | 1891. | 1892. | 1893. | 1894. | 1895. |
|---|---|---|---|---|---|---|---|---|---|
| Coal ........ton.. | $0.90 | $0.70 | $0.47 | $0.45 | $0.43 | $0.41 | $0.40 | $0.40 | $0.37 |
| Flour ........barrel.. | .29 | .17½ | .18 | .13 | .15 | .16½ | .17 | .14 | .14 |
| Wheat ........bushel.. | .07 | .03½ | .04 | .03 | .046 | .036 | .028 | .02½ | .044 |
| Grain ........do.... | .07 | .04½ | .03½ | .02 | .03¼ | .03¾ | .02¾ | .02¾ | .045 |
| Manufactured iron ........ton.. | 2.35 | 1.80 | 2.10 | 1.34 | 2.50 | 2.15 | 2.00 | .90 | 1.50 |
| Pig iron ........do.... | 2.35 | 1.30 | 1.45 | 1.35 | 1.17 | 1.23 | 1.30 | 1.15 | 1.05 |
| Salt ........barrel.. | .18 | .16 | .18 | .15 | .18 | .15 | .12 | .12 | .13 |
| Copper ........ton.. | 2.60 | 2.35 | 2.25 | 2.38 | 2.00 | 1.40 | 1.75 | 1.95 | 1.66 |
| Iron ore ........do.... | 1.75 | 1.28 | 1.14 | 1.10 | .98 | 1.00 | .80 | .70 | .82 |
| Lumber ........M. feet B. M.. | 4.00 | 2.80 | 2.70 | 2.38 | 2.70 | 2.95 | 2.85 | 1.90 | 2.00 |
| Silver ore ........ton.. | 3.00 | 1.90 | 1.90 | 2.25 | 2.25 | 2.25 | 2.25 | 2.25 | 2.33 |
| Building stone ........do.... | 1.15 | 2.05 | 2.02 | 2.00 | 2.00 | 1.67 | 1.36 | 1.28 | 1.20 |
| Unclassified freight ........do.... | 4.00 | 3.00 | 3.00 | 2.75 | 3.58 | 3.60 | 3.00 | 2.75 | 2.50 |

| Items. | 1896. | 1897. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|---|---|
| Coal ........ton.. | $0.32 | $0.30 | $0.25 | $0.46 | $0.44 | $0.38 | $0.45 | $0.53 |
| Flour ........barrel.. | .11 | .10 | .10 | .13 | .12 | .12 | .12 | .12 |
| Wheat ........bushel.. | .02½ | .017 | .02 | .036 | .02 | .023 | .019 | .016 |
| Grain ........do.... | .02½ | .02 | .02 | .036 | .02 | .022 | .019 | .016 |
| Manufactured iron ........ton.. | 1.40 | 1.40 | 1.40 | 1.70 | 2.00 | 2.00 | 2.00 | 2.00 |
| Pig iron ........do.... | 1.05 | 1.05 | 1.05 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 |
| Salt ........barrel.. | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 |
| Copper ........ton.. | 1.95 | 1.95 | 2.00 | 2.00 | 1.60 | 1.65 | 1.40 | 1.43 |
| Iron ore ........do.... | .82 | .65 | .60 | .70 | 1.05 | .78 | .68 | .75 |
| Lumber ........M. feet B. M.. | 1.80 | 1.55 | 1.65 | 3.00 | 2.80 | 2.55 | 2.45 | 2.50 |
| Silver ore ........ton.. | 2.33 | 2.33 | ........ | 2.50 | 2.00 | ........ | 2.00 | ........ |
| Building stone ........do.... | 1.50 | 1.50 | 1.50 | 2.00 | 1.50 | 1.50 | 1.50 | 1.50 |
| Unclassified freight ........do.... | 2.30 | 2.30 | 2.40 | 2.50 | 2.00 | 2.25 | 2.00 | 2.00 |

*Values of total freight carried, by class of commodities, since 1887.*

| Items. | 1887. | 1888. | 1889. | 1890. | 1891. | 1892. |
|---|---|---|---|---|---|---|
| Coal, hard and soft | $4,735,454 | $7,367,644 | $5,702,190 | $7,619,238 | $8,776,362 | $10,164,931 |
| Flour | 7,863,675 | 10,953,625 | 11,143,535 | 16,195,520 | 18,900,715 | 21,672,540 |
| Wheat | 22,634,590 | 18,224,424 | 15,907,217 | 15,893,022 | 38,040,239 | 30,746,085 |
| Grain other than wheat | 759,653 | 1,981,862 | 2,090,580 | 2,003,496 | 1,011,462 | 933,346 |
| Manufactured iron | 3,035,750 | 2,442,950 | 1,577,250 | 4,680,750 | 2,128,000 | 2,988,600 |
| Pig iron | 241,468 | 252,348 | 442,272 | 386,104 | 462,077 | 709,716 |
| Salt | 204,908 | 210,433 | 168,250 | 179,431 | 234,528 | 275,740 |
| Copper | 6,977,200 | 5,792,000 | 6,691,200 | 8,745,800 | 13,838,000 | 12,998,600 |
| Iron ore | 8,741,995 | 8,996,808 | 14,335,492 | 16,711,688 | 12,460,744 | 17,153,962 |
| Lumber | 2,974,068 | 4,326,696 | 5,679,972 | 6,514,722 | 6,593,490 | 9,231,192 |
| Silver ore and bullion | 53,826 | 520,579 | 914,589 | 527,807 | 266,211 | 296,815 |
| Building stone | 134,010 | 335,410 | 335,380 | 479,730 | 440,800 | 396,980 |
| Unclassified freight | 20,675,160 | 20,751,240 | 18,744,600 | 22,277,640 | 25,025,580 | 27,548,760 |
| Total | 79,031,757 | 82,156,019 | 83,732,527 | 102,214,948 | 128,178,208 | 135,117,267 |

| Items. | 1893. | 1894. | 1895. | 1896. | 1897. | 1898. |
|---|---|---|---|---|---|---|
| Coal, hard and soft | $10,528,420 | $8,191,917 | $6,993,351 | $8,452,073 | $9,456,824 | $10,334,461 |
| Flour | 29,682,696 | 33,621,649 | 33,383,632 | 34,199,003 | 40,145,144 | 33,056,683 |
| Wheat | 32,611,239 | 22,316,469 | 30,041,863 | 47,442,347 | 48,654,143 | 49,871,997 |
| Grain other than wheat | 1,346,993 | 772,504 | 4,164,347 | 10,704,748 | 11,449,256 | 13,039,192 |
| Manufactured iron | 2,852,300 | 1,805,350 | 3,688,150 | 4,696,200 | 6,092,400 | 10,709,350 |
| Pig iron | 550,902 | 831,452 | 346,788 | 377,298 | 176,437 | 476,775 |
| Salt | 228,730 | 237,461 | 202,439 | 178,136 | 214,086 | 226,170 |
| Copper | 17,506,000 | 19,914,600 | 21,490,400 | 23,374,400 | 24,464,800 | 29,814,240 |
| Iron ore | 14,050,946 | 17,027,078 | 22,332,319 | 25,705,062 | 31,901,145 | 35,120,880 |
| Lumber | 10,593,810 | 11,564,608 | 8,888,400 | 8,562,325 | 10,875,762 | 12,984,582 |
| Silver ore and bullion | 379,861 | 46,144 | 11,200 | 26,880 | 560 | ............ |
| Building stone | 194,260 | 214,170 | 238,760 | 177,310 | 62,490 | 45,700 |
| Unclassified freight | 24,910,800 | 27,071,100 | 27,798,480 | 31,251,060 | 34,742,880 | 37,388,760 |
| Total | 145,436,957 | 143,114,502 | 159,575,129 | 195,146,842 | 218,235,927 | 233,069,740 |

| Items. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|
| Coal, hard and soft | $12,854,278 | $14,620,840 | $15,492,226 | $16,570,398 | $24,898,407 |
| Flour | 25,610,929 | 27,042,752 | 24,811,637 | 31,185,840 | 31,920,210 |
| Wheat | 43,798,001 | 28,342,511 | 36,440,719 | 55,246,295 | 49,107,642 |
| Grain other than wheat | 17,700,552 | 14,071,953 | 22,779,703 | 25,521,556 | 22,787,909 |
| Manufactured iron | 19,111,000 | 11,551,000 | 17,609,800 | 20,323,380 | 18,385,950 |
| Pig iron | 457,762 | 851,313 | 485,520 | 277,925 | 522,440 |
| Salt | 237,252 | 328,895 | 332,830 | 288,149 | 318,417 |
| Copper | 38,428,800 | 39,319,800 | 26,227,866 | 22,916,280 | 25,961,710 |
| Iron ore | 52,116,016 | 61,663,380 | 58,794,509 | 75,260,420 | 74,709,398 |
| Lumber | 17,646,969 | 15,009,241 | 16,617,922 | 17,736,404 | 18,057,456 |
| Silver ore and bullion | 60,875 | 18,750 | ............ | 125 | ............ |
| Building stone | 468,756 | 586,824 | 559,008 | 467,028 | 255,600 |
| Unclassified freight | 52,873,560 | 54,139,700 | 69,755,125 | 92,512,500 | 82,479,875 |
| Total | 281,364,750 | 267,041,959 | 289,906,865 | 358,306,300 | 349,405,014 |

*Values of freight carried, per unit of each class, since 1887.*

| Items. | 1887. | 1888. | 1889. | 1890. | 1891. | 1892. | 1893. | 1894. | 1895. |
|---|---|---|---|---|---|---|---|---|---|
| Coal: | | | | | | | | | |
| Anthracite...ton.. | $3.50 | $3.50 | $3.50 | $3.50 | $3.50 | $3.50 | $3.50 | $2.93 | $4.25 |
| Bituminous...do... | | | | | | | | | 2.40 |
| Flour...barrel.. | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 4.00 | 4.00 | 3.75 | 3.75 |
| Wheat...bushel.. | .98 | .98 | .98 | .98 | .98 | .75 | .75 | .64 | .65 |
| Grain other than wheat...do... | .98 | .98 | .98 | .98 | .98 | .56 | .56 | .50 | .50 |
| Manufactured iron...ton.. | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| Pig iron...do... | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 | 17.00 | 13.50 | 13.00 |
| Salt...barrel.. | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | .75 |
| Copper...ton.. | 200.00 | 200.00 | 200.00 | 200.00 | 200.00 | 200.00 | 200.00 | 200.00 | 200.00 |
| Iron ore...do... | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 2.60 | 2.77 |
| Lumber...M feet B. M.. | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 | 16.00 | 12.00 |
| Silver ore...ton.. | 153.79 | 153.79 | 153.79 | 153.79 | 153.79 | 153.79 | 153.79 | 112.00 | 112.00 |
| Building stone...do... | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| General merchandise...do... | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 | 60.00 |

*Values of freight carried, per unit of each class, since 1887*—Continued.

| Items | 1896. | 1897. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|---|---|
| Coal: | | | | | | | | |
| Anthracite ................ton.. | $4.75 | $5.50 | $4.75 | $5.70 | $5.25 | $5.60 | $6.25 | $5.80 |
| Bituminous ..............do... | 2.50 | 2.60 | 2.40 | 2.60 | 3.00 | 2.90 | 3.25 | 3.15 |
| Flour ....................barrel.. | 3.85 | 4.50 | 4.25 | 3.60 | 4.00 | 3.25 | 3.50 | 4.50 |
| Wheat ....................bushel.. | .75 | .87 | .80 | .75 | .70 | .69 | .72 | .80 |
| Grain other than wheat.......do... | .39 | .46 | .50 | .59 | .87 | .92 | .92 | .71 |
| Manufactured iron ............ton.. | 50.00 | 50.00 | 50.00 | 100.00 | 100.00 | 100.00 | 110.00 | 110.00 |
| Pig iron ......................do... | 13.50 | 13.25 | 13.25 | 19.50 | 17.50 | 16.00 | 20.75 | 20.00 |
| Salt.......................barrel.. | .75 | .75 | .75 | .75 | 1.00 | .75 | .65 | .70 |
| Copper .......................ton.. | 200.00 | 200.00 | 240.00 | 320.00 | 300.00 | 266.00 | 190.00 | 230.00 |
| Iron ore ......................do... | 3.25 | 3.00 | 3.00 | 3.40 | 3.75 | 3.25 | 3.10 | 3.45 |
| Lumber ..............M feet B. M.. | 12.50 | 13.50 | 14.50 | 17.00 | 16.50 | 15.50 | 16.25 | 18.00 |
| Silver ore......................ton.. | 112.00 | 112.00 | ........ | 125.00 | 125.00 | ........ | 125.00 | ........ |
| Building stone ................do... | 10.00 | 10.00 | 10.00 | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 |
| General merchandise .........do... | 60.00 | 60.00 | 60.00 | 90.00 | 100.00 | 125.00 | 125.00 | 125.00 |

*Statement of commerce through both American and Canadian canals at Sault Ste. Marie, Michigan and Ontario, for each season or calendar year from their opening in 1855.*

TONNAGE AND CLASS OF VESSELS.

| Year. | Date of opening canal. | Date of closing canal. | Sailing vessels. | Steamers. | Unregistered craft. | Total passages. | Registered tonnage. |
|---|---|---|---|---|---|---|---|
| 1855.......................... | June 18 | Nov. 23 | 44 | 149 | .......... | 193 | 106,296 |
| 1856.......................... | May 4 | Nov. 28 | 112 | 178 | .......... | 290 | 101,458 |
| 1857.......................... | May 9 | Nov. 30 | 192 | 184 | .......... | 376 | 180,820 |
| 1858.......................... | Apr. 18 | Nov. 20 | 182 | 224 | .......... | 406 | 219,819 |
| 1859.......................... | May 8 | Nov. 28 | 411 | 258 | .......... | 669 | 352,642 |
| 1860.......................... | May 11 | Nov. 26 | 579 | 337 | .......... | 916 | 403,657 |
| 1861.......................... | May 3 | Nov. 14 | 242 | 296 | .......... | 538 | 276,639 |
| 1862.......................... | Apr. 27 | Nov. 27 | 548 | 295 | .......... | 838 | 359,612 |
| 1863.......................... | Apr. 28 | Nov. 24 | 952 | 305 | .......... | 1,257 | 507,434 |
| 1864.......................... | May 2 | Dec. 4 | 1,045 | 366 | .......... | 1,411 | 571,438 |
| 1865.......................... | May 1 | Dec. 3 | 602 | 395 | .......... | 997 | 409,062 |
| 1866.......................... | May 5 | ...do.... | 555 | 453 | .......... | 1,008 | 458,530 |
| 1867.......................... | May 4 | ...do.... | 839 | 466 | .......... | 1,305 | 556,899 |
| 1868.......................... | May 2 | ...do.... | 817 | 338 | .......... | 1,155 | 432,563 |
| 1869.......................... | May 4 | Nov. 29 | 939 | 399 | .......... | 1,338 | 524,885 |
| 1870.......................... | Apr. 29 | Dec. 1 | 1,397 | 431 | .......... | 1,828 | 690,826 |
| 1871.......................... | May 8 | Nov. 29 | 1,064 | 573 | .......... | 1,637 | 752,101 |
| 1872.......................... | May 11 | Nov. 26 | 1,212 | 792 | .......... | 2,004 | 914,735 |
| 1873.......................... | May 5 | Nov. 18 | 1,519 | 968 | .......... | 2,517 | 1,204,446 |
| 1874.......................... | May 12 | Dec. 2 | 833 | 901 | .......... | 1,734 | 1,070,857 |
| 1875.......................... | ...do.... | ...do.... | 569 | 1,464 | .......... | 2,033 | 1,259,534 |
| 1876.......................... | May 8 | Nov. 26 | 684 | 1,733 | .......... | 2,417 | 1,541,676 |
| 1877.......................... | May 2 | Nov. 30 | 1,401 | 1,050 | .......... | 2,451 | 1,439,216 |
| 1878.......................... | Apr. 8 | Dec. 3 | 1,091 | 1,476 | .......... | 2,567 | 1,667,136 |
| 1879.......................... | May 2 | ...do.... | 1,403 | 1,618 | 100 | 3,121 | 1,677,071 |
| 1880.......................... | Apr. 28 | Nov. 15 | 1,718 | 1,735 | 50 | 3,503 | 1,734,890 |
| 1881.......................... | May 7 | Dec. 5 | 1,706 | 2,117 | 181 | 4,004 | 2,092,757 |
| 1882.......................... | Apr. 21 | Dec. 3 | 1,663 | 2,739 | 372 | 4,774 | 2,468,088 |
| 1883.......................... | May 2 | Dec. 11 | 1,458 | 2,620 | 237 | 4,315 | 2,042,259 |
| 1884.......................... | Apr. 23 | Dec. 10 | 1,709 | 3,609 | 371 | 5,689 | 2,997,837 |
| 1885.......................... | May 6 | Dec. 2 | 1,689 | 3,354 | 337 | 5,380 | 3,035,937 |
| 1886.......................... | Apr. 25 | Dec. 4 | 2,534 | 4,584 | 306 | 7,424 | 4,219,397 |
| 1887.......................... | May 1 | Dec. 2 | 2,562 | 5,968 | 825 | 9,355 | 4,897,598 |
| 1888.......................... | May 7 | Dec. 4 | 2,009 | 5,305 | 489 | 7,803 | 5,130,659 |
| 1889.......................... | Apr. 15 | ...do.... | 2,635 | 6,501 | 443 | 9,579 | 7,221,935 |
| 1890.......................... | Apr. 20 | Dec. 3 | 2,872 | 7,268 | 417 | 10,557 | 8,454,435 |
| 1891.......................... | Apr. 27 | Dec. 7 | 2,405 | 7,339 | 447 | 10,191 | 8,400,685 |
| 1892.......................... | Apr. 18 | Dec. 6 | 3,324 | 8,737 | 519 | 12,580 | 10,647,203 |
| 1893.......................... | May 1 | Dec. 5 | 2,955 | 8,379 | 674 | 12,008 | 8,949,754 |
| 1894.......................... | Apr. 17 | Dec. 6 | 3,676 | 10,208 | 607 | 14,491 | 13,110,366 |
| 1895.......................... | Apr. 25 | Dec. 11 | 4,790 | 12,495 | 671 | 17,956 | 16,806,781 |
| 1896.......................... | Apr. 21 | Dec. 8 | 4,391 | 13,404 | 820 | 18,615 | 17,249,418 |
| 1897.......................... | ...do.... | Dec. 14 | 4,438 | 12,029 | 704 | 17,171 | 17,619,933 |
| 1898.......................... | Apr. 11 | ...do.... | 4,449 | 12,461 | 851 | 17,761 | 18,622,754 |
| 1899.......................... | Apr. 26 | Dec. 20 | 4,776 | 14,378 | 1,101 | 20,255 | 21,958,347 |
| 1900.......................... | Apr. 19 | Dec. 16 | 4,004 | 14,426 | 1,022 | 19,452 | 22,315,834 |
| 1901.......................... | Apr. 20 | Dec. 21 | 4,482 | 14,372 | 1,187 | 20,041 | 24,626,976 |
| 1902.......................... | Apr. 1 | Dec. 20 | 4,368 | 17,069 | 1,222 | 22,659 | 31,955,582 |
| 1903.......................... | Apr. 2 | Dec. 15 | 3,569 | 14,027 | 1,000 | 18,569 | 27,736,444 |

*Statement of commerce through both American and Canadian canals at Sault Ste. Marie, Michigan and Ontario*—Continued.

PASSENGER AND FREIGHT TRAFFIC.

[Tons of 2,000 pounds.]

| Year. | Date of opening canal. | Date of closing canal. | Passengers. | Coal. | Flour. | Wheat. | Grain, other than wheat. | Manufactured and pig iron. | Salt. |
|---|---|---|---|---|---|---|---|---|---|
| | | | *Number.* | *Tons.* | *Barrels.* | *Bushels.* | *Bushels.* | *Tons.* | *Barrels.* |
| 1855.. | June 18 | Nov. 23 | 8,295 | 1,414 | 10,289 | .......... | .......... | 1,445 | 196 |
| 1856.. | May 4 | Nov. 28 | 7,992 | 3,968 | 17,686 | .......... | 82,060 | 2,272 | 1,027 |
| 1857.. | May 9 | Nov. 30 | 6,650 | 5,298 | 18,515 | .......... | 40,637 | 4,426 | 1,118 |
| 1858.. | Apr. 18 | Nov. 20 | 9,230 | 4,118 | 13,782 | .......... | 21,000 | 3,031 | 1,223 |
| 1859.. | May 3 | Nov. 28 | .......... | 8,884 | 39,459 | 74 | 71,738 | 7,172 | 2,737 |
| 1860.. | May 11 | Nov. 26 | .......... | .......... | 50,250 | .......... | 133,437 | 1,446 | .......... |
| 1861.. | May 3 | Nov. 14 | 8,816 | 11,507 | 22,743 | 223 | 76,830 | 4,904 | 3,014 |
| 1862.. | Apr. 27 | Nov. 27 | 8,468 | 11,346 | 17,291 | .......... | 59,062 | 7,023 | 2,477 |
| 1863.. | Apr. 28 | Nov. 24 | 18,281 | 7,805 | 31,975 | .......... | 78,480 | 7,939 | 1,506 |
| 1864.. | May 2 | Dec. 4 | 16,985 | 11,282 | 33,937 | .......... | 143,560 | 9,234 | 1,776 |
| 1865.. | May 1 | Dec. 3 | 19,777 | .......... | 34,985 | .......... | .......... | 7,400 | 3,175 |
| 1866.. | May 5 | ...do.... | 14,067 | 19,915 | 33,603 | .......... | 229,926 | 14,484 | 4,454 |
| 1867.. | May 4 | ...do.... | 15,120 | 22,927 | 28,345 | .......... | 249,031 | 23,141 | 5,316 |
| 1868.. | May 2 | ...do.... | 10,590 | 25,814 | 27,372 | .......... | 285,123 | 23,991 | 4,624 |
| 1869.. | May 4 | Nov. 29 | 17,657 | 27,850 | 32,007 | .......... | 323,501 | 25,604 | 5,910 |
| 1870.. | Apr. 29 | Dec. 1 | 17,153 | 15,952 | 33,548 | 49,700 | 304,077 | 42,049 | 11,089 |
| 1871.. | May 8 | Nov. 29 | 15,859 | 46,798 | 26,060 | 1,376,705 | 308,823 | 57,216 | 36,199 |
| 1872.. | May 11 | Nov. 26 | 25,830 | 80,815 | 136,411 | 567,134 | 445,774 | 100,293 | 42,690 |
| 1873.. | May 5 | Nov. 18 | 30,966 | 96,780 | 172,692 | 2,119,997 | 309,645 | 47,996 | 29,335 |
| 1874.. | May 12 | Dec. 2 | 22,958 | 61,124 | 179,855 | 1,120,015 | 149,999 | 33,713 | 44,231 |
| 1875.. | ...do.... | ...do.... | 19,685 | 101,260 | 309,991 | 1,213,788 | 272,580 | 56,649 | 43,989 |
| 1876.. | May 8 | Nov. 26 | 20,286 | 124,960 | 390,577 | 1,971,549 | 424,468 | 67,409 | 46,666 |
| 1877.. | May 2 | Nov. 30 | 21,800 | 91,575 | 355,117 | 1,349,738 | 378,063 | 42,705 | 63,188 |
| 1878.. | Apr. 8 | Dec. 3 | 20,394 | 91,856 | 344,599 | 1,872,940 | 264,674 | 18,116 | 63,520 |
| 1879.. | May 2 | ...do.... | 18,979 | 110,704 | 451,154 | 2,603,666 | 973,948 | 43,771 | 92,245 |
| 1880.. | Apr. 28 | Nov. 15 | 25,766 | 170,501 | 523,860 | 2,105,920 | 2,553,436 | 54,302 | 77,916 |
| 1881.. | May 7 | Dec. 5 | 24,671 | 295,647 | 605,453 | 3,456,965 | 367,838 | 87,830 | 65,897 |
| 1882.. | Apr. 21 | Dec. 3 | 29,256 | 430,184 | 344,044 | 3,728,856 | 473,129 | 92,870 | 176,612 |
| 1883.. | May 2 | Dec. 11 | 39,130 | 714,444 | 687,031 | 5,900,473 | 776,552 | 109,910 | 70,898 |
| 1884.. | Apr. 23 | Dec. 10 | 54,214 | 706,379 | 1,248,243 | 11,985,791 | 517,103 | 72,428 | 144,804 |
| 1885.. | May 6 | Dec. 2 | 36,147 | 894,991 | 1,440,093 | 15,274,213 | 422,981 | 60,842 | 136,355 |
| 1886.. | Apr. 25 | Dec. 4 | 27,088 | 1,009,999 | 1,759,365 | 18,991,485 | 715,373 | 115,208 | 158,677 |
| 1887.. | May 1 | Dec. 2 | 32,668 | 1,352,987 | 1,572,735 | 23,096,520 | 775,166 | 74,919 | 204,908 |
| 1888.. | May 7 | Dec. 4 | 25,558 | 2,105,041 | 2,190,725 | 18,596,351 | 2,022,308 | 63,703 | 210,433 |
| 1889.. | Apr. 15 | ...do.... | 25,712 | 1,629,197 | 2,228,707 | 16,231,854 | 2,135,245 | 57,561 | 168,250 |
| 1890.. | Apr. 20 | Dec. 3 | 24,856 | 2,176,925 | 3,239,104 | 16,217,370 | 2,044,384 | 116,327 | 179,431 |
| 1891.. | Apr. 27 | Dec. 7 | 26,190 | 2,507,532 | 3,780,143 | 38,816,570 | 1,032,104 | 69,741 | 234,528 |
| 1892.. | Apr. 18 | Dec. 6 | 26,890 | 2,904,266 | 5,418,135 | 40,994,780 | 1,666,690 | 101,520 | 275,740 |
| 1893.. | May 1 | Dec. 5 | 18,869 | 3,008,120 | 7,420,674 | 43,481,652 | 2,405,344 | 89,452 | 228,730 |
| 1894.. | Apr. 17 | Dec. 6 | 27,236 | 2,797,184 | 8,965,773 | 34,869,483 | 1,545,008 | 60,659 | 237,461 |
| 1895.. | Apr. 25 | Dec. 11 | 31,656 | 2,574,362 | 8,902,302 | 46,218,250 | 8,328,694 | 100,337 | 269,919 |
| 1896.. | Apr. 21 | Dec. 8 | 37,066 | 3,023,340 | 8,882,858 | 63,256,463 | 27,448,071 | 121,872 | 237,515 |
| 1897.. | ...do.... | Dec. 14 | 40,213 | 3,039,172 | 8,921,143 | 55,924,302 | 24,889,688 | 135,164 | 285,449 |
| 1898.. | Apr. 11 | ...do.... | 43,426 | 3,776,450 | 7,778,043 | 62,339,996 | 26,078,384 | 250,170 | 301,560 |
| 1899.. | Apr. 26 | Dec. 20 | 49,082 | 3,940,887 | 7,114,147 | 58,397,335 | 30,000,935 | 214,585 | 316,336 |
| 1900.. | Apr. 19 | Dec. 16 | 58,555 | 4,486,977 | 6,760,688 | 40,489,302 | 16,174,659 | 135,585 | 328,895 |
| 1901.. | Apr. 20 | Dec. 21 | 59,663 | 4,593,136 | 7,634,350 | 52,812,636 | 24,760,547 | 206,443 | 443,774 |
| 1902.. | Apr. 1 | Dec. 20 | 59,377 | 4,812,478 | 8,910,240 | 76,730,965 | 27,740,822 | 198,152 | 443,306 |
| 1903.. | Apr. 2 | Dec. 15 | 55,175 | 6,937,633 | 7,093,380 | 61,384,552 | 32,095,646 | 193,267 | 454,882 |

*Statement of commerce through both American and Canadian canals at Sault Ste. Marie, Michigan and Ontario, etc.*—Continued.

PASSENGER AND FREIGHT TRAFFIC—Continued.

| Year. | Date of opening canal | Date of closing canal. | Copper. | Iron ore. | Lumber. | Silver ore and bullion. | Building stone. | Unclassified freight. | Total freight. |
|---|---|---|---|---|---|---|---|---|---|
| | | | *Tons.* | *Tons.* | *M feet B. M.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1855.. | June 18 | Nov. 23 | 3,196 | 1,447 | 127 | .......... | .......... | 5,690 | 14,503 |
| 1856.. | May 4 | Nov. 28 | 5,977 | 11,597 | 433 | .......... | .......... | 5,538 | 33,817 |
| 1857.. | May 9 | Nov. 30 | 4,400 | 26,185 | 680 | .......... | .......... | 7,140 | 51,607 |
| 1858.. | Apr. 18 | Nov. 20 | 6,944 | 31,035 | 188 | .......... | .......... | 9,587 | 57,002 |
| 1859.. | May 3 | Nov. 28 | 7,269 | 65,769 | 766 | .......... | .......... | 25,280 | 122,056 |
| 1860.. | May 11 | Nov. 26 | 9,000 | 120,000 | .......... | .......... | .......... | 14,915 | 153,721 |
| 1861.. | May 3 | Nov. 11 | 7,645 | 44,837 | 664 | .......... | .......... | 12,972 | 87,847 |
| 1862.. | Apr. 27 | Nov. 27 | 6,881 | 113,014 | 240 | .......... | .......... | 19,355 | 161,675 |
| 1863.. | Apr. 28 | Nov. 24 | 1,044 | 181,567 | 1,414 | .......... | .......... | 30,213 | 236,780 |
| 1864.. | May 2 | Dec. 4 | 5,331 | 213,753 | 2,012 | .......... | .......... | 33,477 | 284,350 |
| 1865.. | May 1 | Dec. 3 | 9,935 | 147,459 | 822 | .......... | .......... | 11,226 | 181,638 |
| 1866.. | May 5 | ....do... | 9,550 | 152,102 | 660 | .......... | .......... | 32,310 | 239,457 |
| 1867.. | May 4 | ....do... | 10,585 | 222,861 | 1,177 | .......... | .......... | 33,632 | 325,357 |
| 1868.. | May 2 | ....do... | 12,222 | 191,989 | 1,404 | .......... | .......... | 31,843 | 299,175 |
| 1869.. | May 4 | Nov. 29 | 18,662 | 239,368 | 1,423 | .......... | .......... | 41,813 | 368,326 |
| 1870.. | Apr. 29 | Dec. 1 | 11,301 | 409,850 | 814 | 92 | 4,500 | 40,342 | 539,883 |
| 1871.. | May 8 | Nov. 29 | 14,562 | 327,461 | 1,098 | 464 | 5,528 | 74,227 | 585,583 |
| 1872.. | May 11 | Nov. 26 | 14,986 | 383,105 | 1,853 | 306 | 5,213 | 109,663 | 746,258 |
| 1873.. | May 5 | Nov. 18 | 15,947 | 504,121 | 2,191 | 580 | 2,218 | 123,398 | 888,432 |
| 1874.. | May 12 | Dec. 2 | 15,345 | 427,658 | 686 | 443 | 401 | 55,312 | 655,138 |
| 1875.. | ....do... | ....do... | 18,396 | 493,408 | 4,498 | 847 | 2,978 | 70,128 | 833,465 |
| 1876.. | May 8 | Nov. 26 | 25,756 | 609,752 | 17,820 | 985 | 2,102 | 91,119 | 1,073,570 |
| 1877.. | May 2 | Nov. 30 | 16,767 | 568,082 | 15,373 | 1,020 | 2,506 | 64,201 | 912,639 |
| 1878.. | Apr. 8 | Dec. 3 | 22,529 | 555,750 | 34,889 | 768 | 2,754 | 69,007 | 937,351 |
| 1879.. | May 2 | ....do... | 22,309 | 540,075 | 43,439 | 324 | 2,226 | 81,279 | 1,050,784 |
| 1880.. | Apr. 28 | Nov. 15 | 21,753 | 677,073 | 48,635 | 66 | 2,283 | 100,849 | 1,321,906 |
| 1881.. | May 7 | Dec. 5 | 29,488 | 748,131 | 58,877 | .......... | 1,400 | 129,031 | 1,567,741 |
| 1882.. | Apr. 21 | Dec. 3 | 25,409 | 987,060 | 82,783 | 22 | 5,428 | 172,167 | 2,029,521 |
| 1883.. | May 2 | Dec. 11 | 31,024 | 791,732 | 87,131 | 814 | 2,405 | 191,571 | 2,267,105 |
| 1884.. | Apr. 23 | Dec. 10 | 36,062 | 1,136,071 | 122,389 | 9,731 | 6,047 | 207,173 | 2,874,557 |
| 1885.. | May 6 | Dec. 2 | 31,927 | 1,235,122 | 127,984 | 3,669 | 8,189 | 184,963 | 3,256,628 |
| 1886.. | Apr. 25 | Dec. 4 | 38,627 | 2,087,809 | 138,688 | 2,009 | 9,449 | 230,726 | 4,527,759 |
| 1887.. | May 1 | Dec. 2 | 34,886 | 2,497,713 | 165,226 | 850 | 13,401 | 344,586 | 5,494,649 |
| 1888.. | May 7 | Dec. 4 | 28,960 | 2,570,517 | 240,372 | 3,385 | 33,541 | 345,854 | 6,411,423 |
| 1889.. | Apr. 15 | ....do... | 33,456 | 4,095,855 | 315,554 | 5,947 | 33,538 | 312,410 | 7,516,022 |
| 1890.. | Apr. 20 | Dec. 3 | 43,729 | 4,774,768 | 361,929 | 3,432 | 47,973 | 371,294 | 9,041,213 |
| 1891.. | Apr. 27 | Dec. 7 | 69,190 | 3,560,213 | 366,305 | 1,731 | 44,080 | 417,093 | 8,888,759 |
| 1892.. | Apr. 18 | Dec. 6 | 64,993 | 4,901,132 | 512,844 | 1,930 | 39,698 | 459,146 | 11,214,333 |
| 1893.. | May 1 | Dec. 5 | 87,530 | 4,014,556 | 588,545 | 2,470 | 19,426 | 415,180 | 10,796,572 |
| 1894.. | Apr. 17 | Dec. 6 | 99,573 | 6,548,876 | 722,788 | 412 | 21,417 | 451,185 | 13,195,860 |
| 1895.. | Apr. 25 | Dec. 11 | 107,402 | 8,062,209 | 740,700 | 100 | 23,876 | 463,308 | 15,062,580 |
| 1896.. | Apr. 21 | Dec. 8 | 116,872 | 7,909,250 | 684,986 | 240 | 17,731 | 520,851 | 16,239,061 |
| 1897.. | ....do... | Dec. 14 | 122,324 | 10,633,715 | 805,612 | 5 | 6,249 | 579,048 | 18,982,755 |
| 1898.. | Apr. 11 | ....do... | 124,226 | 11,706,960 | 895,485 | .......... | 4,670 | 623,146 | 21,234,664 |
| 1899.. | Apr. 26 | Dec. 20 | 120,090 | 15,328,240 | 1,038,057 | 487 | 39,063 | 587,484 | 25,255,810 |
| 1900.. | Apr. 19 | Dec. 16 | 131,066 | 16,443,568 | 909,651 | 110 | 48,902 | 541,397 | 25,643,073 |
| 1901.. | Apr. 20 | Dec. 21 | 98,601 | 18,090,618 | 1,072,124 | .......... | 46,584 | 558,041 | 28,403,065 |
| 1902.. | Apr. 1 | Dec. 20 | 120,612 | 24,277,555 | 1,091,471 | 1 | 38,919 | 740,100 | 35,961,146 |
| 1903.. | Apr. 2 | Dec. 15 | 112,877 | 21,654,898 | 1,003,192 | .......... | 21,300 | 659,839 | 34,674,437 |

**St. Marys Falls Canal, Michigan, State lock, 1855 to 1887.**
**St. Marys Falls Canal, Michigan, Weitzel lock, since September 1, 1881.**
**St. Marys Falls Canal, Michigan, Poe lock, since August 3, 1896.**
**Sault Ste. Marie Canal, Ontario, Canadian lock, since September 9, 1895.**

## HISTORICAL NOTES.

The fall in St. Marys Rapids varies from 16½ to 20½ feet in a distance of three fourths of a mile.

The first lock was built on the Canadian side of the river by the Hudson Bay Fur Company in 1798. It was 38 feet long, 8 feet 9 inches wide, with a lift of 9 feet. A towpath was made along the shore for oxen to pull the batteaux and canoes through the upper part of the rapids. This lock, excepting its timber floor and miter sills, was destroyed in 1814 by United States troops from Mackinac Island under command of Major Holmes.

The first ship canal, known as the State Canal, was built on the American side of the river in 1853 to 1855, some 750,000 acres of land in Michigan having been granted by the United States Congress for the construction thereof. The canal was 1 1/12 miles long, 64 feet wide at bottom, 100 feet wide at water surface, and 13 feet deep. There were two tandem locks of masonry, each 350 by 70 feet, having 11½ feet on the miter sills and a lift of about 9 feet each. Charles T. Harvey was superintendent of construction, and the St. Marys Falls Ship Canal Company was the contractor. The locks were destroyed in 1888 by excavations for the present Poe lock.

The Weitzel lock, 515 feet long, 80 feet wide in chamber, narrowing to 60 feet at the gates, was built by the United States in the years 1870 to 1881. The depth of water on the miter sills is 17 feet when the upper pool is 601.9 feet and the lower pool 584.4 feet above mean tide at New York. At the same time the depth of the canal was increased to 16 feet, the mean width to 160 feet; and the stone slope walls were replaced with timber piers having a vertical face. Gen. Godfrey Weitzel was the engineer officer in charge of the district from 1872 to 1882, and Alfred Noble was the assistant engineer in local charge from 1870 to 1882. Boyle and Roach were the principal contractors.

The Canadian canal, 1⅛ miles long, 150 feet wide and 22 feet deep, with lock 900 feet long, 60 feet wide, having 22 feet on the miter sills, was built on the north side of the river between the years 1888 and 1895. Hon. Collingwood Schreiber was chief engineer of Dominion canals, etc., and W. G. McNeill Thompson was the Government engineer in local charge of construction work. Ryan & Haney were the contractors.

The Poe lock, 800 feet long, 100 feet wide, and having 22 feet of water on the sills, was built by the United States in the years 1887 to 1896. Gen. Orlando M. Poe was the engineer officer in charge of the district from 1884 to 1895, and E. S. Wheeler the assistant engineer in local charge of construction work from 1882 to 1897. Hughes Brothers & Bangs were the principal contractors.

The American Canal since 1892 has been deepened to 25 feet, and its entrance piers have been extended so that its total length at the falls is now 1⅗ miles. Its width is variable, being 500 feet at the upper entrance, 108 feet at the canal gate, 270 feet at the basin above locks, and 1,000 feet at the lower entrance. Dunbar & Sullivan and James B. Donnelly were the principal contractors.

The canal also practically includes that part of the channel through St. Marys River which has been gradually improved through shoals of sand, clay, bowlders, sandstone, and limestone rock for a distance of 34 miles, so that for a least width of 300 feet there is a safe navigable depth of about 19 feet at present stage of water. Col. G. J. Lydecker was the engineer officer in charge of the district from 1896 to 1902, and Maj. W. H. Bixby from 1902 to 1904. John Hickler & Sons, C. F. & H. T. Dunbar, and Carkin, Stickney & Cram were the principal contractors.

The approximate cost in round numbers of the several improvements is as follows:

| | |
|---|---|
| Locks and canal of 1855 | $1,000,000 |
| Weitzel lock | 1,000,000 |
| Poe lock | 3,000,000 |
| Widening and deepening canal | 3,000,000 |
| Improving channel through river | 3,000,000 |
| Canadian lock, canal, and approaches | 4,000,000 |

Hydraulic power is used for operating the American locks, a pressure of 115 pounds per square inch being used for the Weitzel lock machinery and a pressure of 380 pounds for the Poe lock machinery. Electricity generated by water power is used for operating the Canadian lock.

The Poe lock can be filled or emptied in about seven minutes, and an up-lockage of a boat 350 feet long has been made in as short an interval as eleven minutes. The gates can be opened or closed in two and one-fourth minutes, although three to five minutes are usually taken. The Weitzel lock can be operated in about the same time as the Poe lock. The Canadian lock can be operated in about nine minutes.

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### REPORT OF MR. JOSEPH RIPLEY, ASSISTANT ENGINEER.

United States Engineer Office,
*Sault Ste. Marie, Mich., July 1, 1904.*

Colonel: I have the honor to submit the following report relative to operating and care of St. Marys Falls Canal, Michigan, for the fiscal year ending June 30, 1904:

## ORGANIZATION.

The regular force of 93 persons, viz, 1 general superintendent, 1 superintendent, 4 clerks, 1 chief engineman, 3 assistant superintendents, 1 overseer, 6 lockmasters, 6 enginemen, 7 watchmen, 1 storekeeper, 2 recorders, 3 messengers, 9 first-grade lockmen, 9 second-grade lockmen, 15 third-grade lockmen, and 24 linemen were severally employed from nine to twelve months in locking boats, office work, and care of property.

There were 15 laborers employed six months in repairing piers, grading, and care of grounds.

Carpenters, a painter, stonecutter, and calker were occasionally employed.

## REPAIRS.

The ordinary maintenance and fitting-out repairs included the fixing or renewal of all damaged, worn-out, or broken parts of the operating machinery, the painting of gates, the refilling of piers, and the replacing of broken masonry with concrete.

The repairs specially made on the Poe lock were as follows: After laying up the lock for the winter season the regular operating force was employed removing oil from the pressure pipes, taking apart hydraulic force pumps, turbines, and capstans, cleaning, repacking same, and testing of all the machinery.

Under emergency contract dated August 26, 1903, the Vulcan Iron Works, Chicago, Ill., furnished and delivered 10 valve engines for the Poe lock culverts. The shopwork and tests were inspected by Chief Engineman E. Green at the company's works in Chicago, and after delivery in December the engines were put on scows and lowered to place on floor as the lock was pumped out.

The old valve engines and their timber beds were removed from the culverts, recesses cut in the concrete and timber bulkheads, and the 10 new 12-inch valve engines installed. This work necessitated turning of the valves end for end, riveting loose plates on same, reboring brasses in lugs, making new rod pins, reriveting brackets, and the bolting of timber buffers on culvert walls.

From the three accumulators in the power house 75 tons of iron weights were removed in order to reduce the working pressure 200 pounds, the operation of the new 12-inch valve engines requiring only half the pressure used for the old 8-inch ones.

The pressure pipes leading to new valve engines were fitted and those to reversing cylinders rearranged to permit of easier access in case of accident. A plank conduit 4 by 4 feet and 600 feet long was built around pressure pipes along south side of Poe lock, and the excess excavation from the trench was used for grading and filling piers.

The iron gratings over the culvert wells were remodeled to fit about the new valve engines, and those over the emptying well were lowered 8 inches, so that the intermediate gates will swing clear of loose rope fenders.

The cleaning and painting interiors of lower, intermediate, and upper lock gates was thoroughly done. The interior of upper gates had not been painted for eight years. Eight manholes were put in those gates to permit easy access and to provide ventilation for the painters.

Repairs to lock floor were made by cutting and threading 50 broken rods in filling culverts for turn-buckles.

The broken stone in coping and hollow quoins of lock walls were repaired with concrete, and new oak fenders were made to replace worn-out ones on face of lock walls at gate recesses.

The rusted sheets of iron roofing on power house and office building were replaced with zinc ones.

The Weitzel lock repairs included the placing of center cable sheaves on upper breast wall, the overhauling and packing of wall and valve engines, turbines, accumulator, and hydraulic force pumps, adjusting and fastening gate cables; the painting of gates, snubbing posts and electric-light poles; and repairing broken masonry with concrete.

Repairs to south leaf of lower lock gate consisted in removing miter post and replacing all broken bolts in girders and fender straps, erecting shed on lock floor for shelter of carpenters, framing new miter post out of three pieces of oak, strapping it in place, adjusting truss rods, and replacing sheathing on gate.

The platforms on lock floor of Weitzel lock were cut down 3 inches to increase draft of water, but still leaving them 3 inches above lower miter sill.

The repairs to canal piers consisted in rebuilding 200 feet of superstructure to south pier below Weitzel lock, and the raising and repairing cement sidewalk adjacent thereto.

A derrick boat was employed from Hickler Brothers September 18 and 19, 1903, for 16⅚ hours, at $5.50 per hour, in picking up 10 cubic yards of rock, the pieces having been dragged by towlines into a pile at the railway swing bridge so that passing boats were striking on them.

### ACCIDENTS.

There was no loss of life from accidents during the year; and the only personal injury sustained was when Lineman Chapiesky had his hand crushed while placing cable on snubbing post.

There were 29 minor accidents resulting in damage to property, such as breaking 23 pieces of timber in canal piers, 13 pieces of coping from lock walls, 3 pieces of hand rail and gate decking, guard plate over cable sheaves; and in pulling out 4 snubbing posts along canal piers; shoving top timbers back and breaking 2 stones in concrete walk.

### DELAYS.

*Poe lock.*—Navigation through the Poe lock was delayed during the year 35 hours and 43 minutes, as follows: 1 hour 40 minutes due to removing rope fenders lodged against miter sills of gates; 25 minutes waiting for tug to assist schooner out of lock; 28 hours pumping out lock to repack valve engines preparatory to substituting oil for water in pressure pipes; 38 minutes grounding of steamer on fender on lock floor; 20 minutes due to breaking of towline; 2 hours 15 minutes repairing broken cable on southwest gate; 1 hour 40 minutes to jamming of boats in lock; and 45 minutes putting in new valve in north intermediate gate engine.

*Weitzel lock.*—The delays in this lock amounted to 1 hour and 35 minutes, as follows: 1 hour repairing broken cable bolt, and 35 minutes to jamming of boats in lock.

### REPORTS.

Of the special reports the most important submitted was that pertaining to statistics of commerce passing the American and Canadian canals at Sault Ste. Marie, Mich., and Ontario, during the calendar year 1903.

Others related to modification of permits to water-power companies as to operations in the rapids, fire protection of United States property at canal, data pertaining to Detroit River commerce, classification and duties of employees, semicentennial celebration of the completion of the State Canal, and construction features and cost of locks.

### PERMITS.

Under date of July 30, 1903, the Secretary of War modified permit issued to Edison Sault Electric Company March 10, 1903, in certain particulars as to operations in the rapids.

Under permit from the Secretary of War dated August 7, 1903, the city of Sault Ste. Marie moved the waterworks boiler across canal grounds and pier July 27 and 28.

*Statistical report of lake commerce through canals at Sault Ste. Marie, Mich., and Ontario, for the fiscal year ending June 30, 1904.*

| Items. | United States canal. | Canadian canal. | Total. |
|---|---|---|---|
| Vessel passages ........number.. | 11,232 | 3,497 | 14,729 |
| Lockages ........do.... | 6,688 | 2,683 | 9,371 |
| Registered tonnage ........net tons.. | 17,059,950 | 3,710,014 | 20,769,964 |
| Freight tonnage ........do.... | 21,889,058 | 4,429,601 | 26,318,659 |
| Passengers ........number.. | 21,426 | 22,480 | 43,906 |
| Coal: | | | |
| Hard ........net tons.. | 938,722 | 122,361 | 1,061,083 |
| Soft ........do.... | 3,603,739 | 764,012 | 4,367,751 |
| Flour ........barrels.. | 3,423,778 | 1,986,351 | 5,410,129 |
| Wheat ........bushels.. | 23,859,524 | 27,851,697 | 51,711,221 |
| Grain other than wheat ........do.... | 25,296,313 | 5,212,305 | 30,508,618 |
| Manufactured and pig iron ........net tons.. | 113,783 | 66,304 | 180,087 |
| Salt ........barrels.. | 278,885 | 115,641 | 394,526 |
| Copper ........net tons.. | 79,143 | 13,071 | 92,214 |
| Iron ore ........do.... | 13,607,405 | 1,993,068 | 15,600,473 |
| Lumber ........M feet B. M.. | 868,041 | 39,801 | 907,842 |
| Silver ore ........net tons.. | 235 | 172 | 407 |
| Building stone ........do.... | 22,460 | ........ | 22,460 |
| General merchandise ........do.... | 389,823 | 208,044 | 597,867 |

NOTE.—The United States canal was open to navigation 225 days during the fiscal year. The Canadian canal was open to navigation 228 days during the fiscal year.

*Comparative statement of commerce through St. Marys Falls Canal, Michigan, for the fiscal years 1903 and 1904.*

| | Fiscal year— | | Increase. | Decrease. |
|---|---|---|---|---|
| | 1903. | 1904. | | |
| Vessel passages ........ number.. | 16,615 | 11,232 | ............ | 5,383 |
| Lockages ........ do.... | 9,140 | 6,688 | ............ | 2,452 |
| Tonnage: | | | | |
| Registered ........ net tons.. | 26,557,413 | 17,059,950 | ............ | 9,497,463 |
| Freight ........ do.... | 31,628,365 | 21,889,058 | ............ | 9,739,307 |
| Passengers ........ number.. | 21,966 | 21,426 | ............ | 540 |
| Coal ........ net tons.. | 5,173,301 | 4,542,461 | ............ | 630,840 |
| Flour ........ barrels.. | 5,369,103 | 3,423,778 | ............ | 1,945,325 |
| Wheat ........ bushels.. | 41,355,155 | 23,859,524 | ............ | 17,495,631 |
| Grain, other than wheat ........ do.... | 24,472,337 | 25,296,313 | 823,976 | ............ |
| Manufactured and pig iron ........ net tons.. | 142,458 | 113,783 | ............ | 28,675 |
| Salt ........ barrels.. | 277,676 | 278,885 | 1,209 | ............ |
| Copper ........ net tons.. | 101,221 | 79,143 | ............ | 22,078 |
| Iron ore ........ do.... | 21,583,831 | 13,607,405 | ............ | 7,976,426 |
| Lumber ........ M feet B. M.. | 1,019,652 | 868,041 | ............ | 151,611 |
| Silver ore ........ net tons.. | 1 | 235 | 234 | ............ |
| Building stone ........ do.... | 22,303 | 22,460 | 157 | ............ |
| General merchandise ........ do.... | 475,464 | 389,823 | ............ | 85,641 |

*Summary of traffic through St. Marys Falls Canal, Michigan, for the fiscal year ending June 30, 1904.*

| | |
|---|---|
| Number of vessels through Weitzel lock ........ | 4,170 |
| Number of vessels through Poe lock ........ | 7,062 |
| Number of lockages through Weitzel lock ........ | 2,737 |
| Number of lockages through Poe lock ........ | 3,951 |
| Total registered tonnage ........ | 17,059,950 |
| Total freight tonnage ........ | 21,889,058 |
| Total time spent in making lockages ........ | 3,220 hrs. 16 min. |
| Average time spent in making a lockage ........ | 28 min. 54 sec. |
| Total time spent by vessels in passing locks ........ | 5,325 hrs. 38 min. |
| Average time spent by vessels in passing locks ........ | 28 min. 27 sec. |
| Cost per lockage ........ | $13.89 |
| Cost per passage ........ | $8.27 |
| Cost per registered ton ........ mills.. | 5.45 |
| Cost per freight ton ........ do.... | 4.25 |

The Weitzel lock was open to navigation 198 days, from July 1 to November 25, 1903, and from May 12 to June 30, 1904.

The time for the Poe lock was 225 days, from July 1 to December 15, 1903, and from May 5 to June 30, 1904.

Compared with the previous fiscal year, the commerce through St. Marys Falls Canal, Michigan, shows a decrease in the following items: Passages, 32 per cent; lockages, 27 per cent; registered tonnage, 36 per cent; freight tonnage, 31 per cent; passengers, 2 per cent; coal, 12 per cent; flour, 36 per cent; wheat, 42 per cent; manufactured and pig iron, 20 per cent; copper, 22 per cent; iron ore, 37 per cent; lumber, 15 per cent, and general merchandise, 18 per cent. An increase of 3 per cent is shown in the item of grain, other than wheat.

In comparing the total traffic through the American and Canadian canals at Sault Ste. Marie, Michigan and Ontario, with the previous fiscal year, it shows a decrease as follows: Passages, 31 per cent; lockages, 25 per cent; registered tonnage, 33 per cent; freight tonnage, 28 per cent, and passengers, 22 per cent.

The August freight traffic of 5,403,808 tons was the maximum record, being 124,380 tons more than for any previous month.

The September traffic in comparison with September, 1902, decreased 407,882 tons, and was due to laying up of steamers by the Pittsburg Steamship Company on account of strike by Mates' Union.

A similar comparison of the October traffic shows a decrease of 142,326 tons, and was due to blockade at St. Clair Flats Canal by sinking of the steamer *John N. Glidden*.

From opening of navigation this season to June 30, a decrease of 8,354,778 tons is shown when compared with the previous year; and was due partly to the late opening of navigation, but principally to the strike of the Masters and Pilots' Association, which was in force from opening of season to June 13.

The canal post-office delivered 109,566 pieces of mail, consisting of 96,703 letters, 4,966 postals, 7,260 newspapers, and 637 parcels. In addition to this, 670 pieces were returned to the city post-office after being held thirty days uncalled for, and 4,110 pieces were forwarded to new addresses.

The receipts from sale of 1,230 charts of the Great Lakes and connecting rivers amounted to $209.05.

The compilation of traffic statements was done by clerks Frank T. McArthur and John McMahon.

Very respectfully, your obedient servant,

JOSEPH RIPLEY,
*General Superintendent.*

Lieut. Col. CHAS. E. L. B. DAVIS,
*Corps of Engineers.*

## O O 4.

## IMPROVEMENT OF HAY LAKE AND NEEBISH CHANNEL, ST. MARYS RIVER, MICHIGAN.

This improvement was commenced in 1883 and opened to navigation June 7, 1894. The result was a new line of travel through the St. Marys River, 11 miles shorter and 4 feet deeper than that previously available, and one which can be navigated at night with a reasonable degree of safety. The width of channel was 300 feet and the general navigable depth 20 feet; but the first step in the work had been in rock cutting through the Middle Neebish section, and there the bottom grade was about 2 feet higher than in the other parts of the improvement. Work since 1895 has been applied to increasing the width of channel at critical points, to the removal of some isolated shoals that have been discovered in the meantime, and to making the depth through the Middle Neebish section equal to that of the other portions of the improved channel.

The river and harbor act of June 13, 1902, adopted a project which provided for a channel of 21 feet available depth at low water and 1,000 feet width from St. Marys Fall Canal to the upper entrance to Hay Lake (Little Rapids), thence a least width of 600 feet to the foot of Hay Lake, thence deepening to 21 feet the present 300-foot channel to Mud Lake via Middle Neebish and opening a new 300-foot channel to Mud Lake via West Neebish, thus providing separate channels through this stretch for up and down bound boats. The total expenditures to June 30, 1904, are $2,738,081.39, leaving $1,221,033.61 available for further payment.

Operations for the present fiscal year are as follows:

In the Hay Lake channel the upper entrance was widened for a distance of 3,850 feet and width of 600 feet by the removal of 396,419 cubic yards, bank measurement, under contract commencing September 23, 1901, and ending November 16, 1903, and two derrick scows removed 3,046 cubic yards of bowlders and leveled off narrow ridges of gravel and hardpan.

By previous improvements the channel at the upper turn to Hay Lake had been made 18 feet deep for a width of 600 feet above and

300 feet below the angle. Now, for a distance of half a mile, both sides of the turn, there is a channel 21 feet deep at lowest stage of water, the width being 1,000 feet above and 600 feet below the angle.

Below the islands, at Little Rapids, the channel was improved for a distance of 10,200 feet by widening on the east side 150 feet to a depth of 21 feet, the work being done by contract between June 17, 1902, and November 3, 1903, the two dredges employed removing 957,528 cubic yards.

In January, 1904, a survey of this section of the channel was made through the ice, and examinations were made by swinging raft bars suspended at 21 feet grade, and before final acceptance the sections were covered without striking any obstructions.

In improving the Middle and West Neebish channels during the year isolated shoals were removed between the canal and Little Rapids so as to secure eventually a navigable depth 21 feet deep and 1,000 feet wide. A test cut was made through Bayfield shoal to determine the character of the material.

At West Neebish Rapids a contract has been let for the construction of a channel 300 feet wide and 22 feet deep for a distance of 13,300 feet through the rapids, with a stone retaining wall along each edge of the rock cut. About 6,000 linear feet of the cut is to be inclosed by cofferdams and the included portion of the channel excavated in the dry. Preliminary work was begun May 16, 1904, and at the close of the year the contractors had made good progress, an intermediate cofferdam, the commencement of the upper dam, roadways, framing of cable towers for the telferage system, boarding houses, store, dock, and assembling of plant being well under way.

At various other portions of the improvement of this waterway 357,073 cubic yards of material, bank measurement, have been excavated and channels correspondingly improved, and many surveys have been made.

The work was in charge of Assistant Engineer Joseph Ripley, to whose report, hereto appended, attention is invited for the detailed description of the work at each locality.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,364,120.68 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | [a] 143,087.07 |
| July 1, 1904, balance unexpended | 1,221,033.61 |
| July 1, 1904, outstanding liabilities | 35,300.82 |
| July 1, 1904, balance available | 1,185,732.79 |
| July 1, 1904, amount covered by uncompleted contracts | 3,780,068.33 |
| Amount (estimated) required for completion of existing project | 3,200,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 500,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

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[a] Includes $0.84 paid by Treasury Department, account of Michigan Central Railroad Company.

### APPROPRIATIONS.

*Hay Lake channel.*

| | |
|---|---|
| August 2, 1882 | $200,000 |
| July 5, 1884 | 125,000 |
| August 5, 1886 | 150,000 |
| August 11, 1888 | 500,000 |
| September 19, 1890 | 400,000 |
| March 3, 1891 (sundry civil act) | 300,000 |
| August 5, 1892 (sundry civil act) | 115,000 |
| March 3, 1893 (sundry civil act) | 225,000 |
| August 18, 1894 (sundry civil act) | 150,000 |
| March 3, 1899 | 100,000 |
| June 6, 1900 (sundry civil act) | 250,000 |
| June 28, 1902 (sundry civil act) | 144,115 |
| *Middle and West Neebish channels.* | |
| June 13, 1902 | 500,000 |
| March 3, 1903 (sundry civil act) | 800,000 |
| Total | 3,959,115 |

### ABSTRACTS OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract dated September 16, 1901.*

Name of contractor: Henry Hickler, Sault Ste. Marie, Mich.
Amount and character of work: $131,881.43; dredging section 1, Hay Lake channel.
Price per unit: 56 cents per cubic yard, bank measurement (full rate), and 28 cents per cubic yard, bank measurement (half rate).
Date of approval: September 30, 1901.
Date of beginning of work: October 12, 1901.
Date of expiration (as extended): Indefinite. Completed November 16, 1903.

*Contract dated June 5, 1902.*

Name of contractor: Chas. Simono, Two Rivers, Wis.
Amount and character of work: $90,799.44; dredging section 3, Hay Lake channel.
Price per unit: 12 cents per cubic yard, bank measurement (full rate), and 6 cents per cubic yard, bank measurement (half rate).
Date of approval: June 28, 1902.
Date of beginning of work: About August 15, 1902.
Date of expiration: About June 2, 1904. Completed November 3, 1903.

*Emergency contract dated November 7, 1902.*

Name of contractor: The Lake Erie Dredging Company, Buffalo, N. Y.
Amount and character of work: $32,544.50; time work by dredging plant.
Price per unit: $17.50 per working hour.
Date of beginning of work: November 24, 1902.
Date of expiration: About November 2, 1903. Completed November 10, 1903.

*Emergency contract dated November 7, 1902.*

Name of contractor: Samuel O. Dixon, Milwaukee, Wis.
Amount and character of work: $15,532.80; time work by dredging plant.
Price per unit: $18 per working hour.
Date of beginning of work: November 18, 1902.
Date of expiration: About October 20, 1903. Completed July 23, 1903.

*Emergency contract dated September 8, 1903.*

Name of contractor: H. W. Hubbell & Co., Saginaw, Mich.
Amount and character of work: $5,265.80; time work by dredging plant.
Price per unit: $15 per working hour.
Date of beginning of work: September 18, 1903.
Date of expiration: About October 20, 1903. Completed October 30, 1903.

*Contract dated April 7, 1904.*

Name of contractor: MacArthur Brothers Company, Chicago, Ill.

Amount and character of work: $2,419.560; rock and earth excavation at West Neebish Rapids.

Price per unit: Cofferdam, $20,000; earth excavation at 56 cents per cubic yard, bank measurement (full rate), and 28 cents per cubic yard, bank measurement (half rate); rock excavation, $1.36 per cubic yard, bank measurement (full rate), and 68 cents per cubic yard, bank measurement (half rate); retaining walls at $5.50 per square yard of channel face.

Date of approval: May 7, 1904.
Date of beginning of work: July 11, 1904.
Date of expiration: (1,200 good working days) about June 10, 1908.

*Contract dated April 11, 1904.*

Name of contractor: Charles Simono, Two Rivers, Wis.

Amount and character of work: $56,800 (estimated); dredging section 1, Little Rapids.

Price per unit: 17¾ cents per cubic yard, bank measurement (full rate), and 8⅞ cents per cubic yard, bank measurement (half rate).

Date of approval: April 22, 1904.
Date of beginning of work: May 1, 1904.
Date of expiration (200 good working days): About May 24, 1905.

*Contract dated April 11, 1904.*

Name of contractor: H. W. Hubbell & Co., Saginaw, Mich.

Amount and character of work: $67,404 (estimated); dredging section 3, Ninemile Point.

Price per unit: 98.4 cents per cubic yard, bank measurement (full rate), and 49.2 cents per cubic yard, bank measurement (half rate).

Date of approval: April 18, 1904.
Date of beginning of work: May 1, 1904.
Date of expiration (200 good working days): About May 24, 1905.

*Contract dated April 11, 1904.*

Name of contractor: Samuel O. Dixon, Milwaukee, Wis.

Amount and character of work: $685,312.50 (estimated); dredging section 1, Hay Lake.

Price per unit: 12¾ cents per cubic yard, bank measurement (full rate), and 6⅜ cents per cubic yard, bank measurement (half rate).

Date of approval: April 18, 1904.
Date of beginning of work: September 1, 1904.
Date of expiration (500 good working days): About October 17, 1906.

*Contract dated April 14, 1904.*

Name of contractor: The Lake Erie Dredging Company, Buffalo, N. Y.
Amount and character of work: $131,812.50; dredging section 2, Little Rapids.

Price per unit: 13⅝ cents per cubic yard, bank measurement (full rate), and $6\frac{13}{16}$ cents per cubic yard, bank measurement (half rate).

Date of approval: April 27, 1904.
Date of beginning of work: May 1, 1904.
Date of expiration (350 good working days): About November 22, 1905.

*Contract dated April 16, 1904.*

Name of contractor: Chicago and Great Lakes Dredge and Dock Company, Chicago, Ill.

Amount and character of work: $466,915.50; dredging section 2, Mud Lake.

Price per unit: Soft material, at $0.129 per cubic yard, bank measurement (full rate), and $0.0645 per cubic yard, bank measurement (half rate). Hard material, at $0.98 per cubic yard, bank measurement (full rate), and $0.49 per cubic yard, bank measurement (half rate). Rock, at $8.25 per cubic yard, bank measurement (full rate), and $4.125 per cubic yard, bank measurement (half rate).

Date of approval: May 6, 1904.

Date of beginning of work: September 1, 1904.

Date of expiration (500 good working days): About October 17, 1906.

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## COMMERCIAL STATISTICS.

*Table showing extent and growth of commerce through Hay Lake channel, as derived from official records of St. Marys Falls canals, Michigan and Ontario.*

| Season of navigation. | Freight. | Valuation. | Passengers. |
|---|---|---|---|
| | *Tons.* | | |
| 1894 | 13,195,860 | $143,114,502 | 27,236 |
| 1895 | 15,062,580 | 159,575,129 | 31,656 |
| 1896 | 16,239,061 | 195,146,842 | 37,066 |
| 1897 | 18,982,755 | 218,235,927 | 40,213 |
| 1898 | 21,234,664 | 233,069,739 | 43,426 |
| 1899 | 25,255,810 | 281,364,750 | 51,050 |
| 1900 | 25,643,073 | 267,041,959 | 58,555 |
| 1901 | 28,403,065 | 289,906,865 | 59,663 |
| 1902 | 35,961,146 | 358,306,300 | 59,377 |
| 1903 | 34,674,437 | 349,405,014 | 55,175 |

## REPORTS OF MR. JOSEPH RIPLEY, ASSISTANT ENGINEER.

United States Engineer Office,
*Sault Ste. Marie, Mich., July 1, 1904.*

Colonel: I have the honor to submit the following report of operations for improving Hay Lake channel during the fiscal year ending June 30, 1904.

### SECTION 1.—WIDENING AT LITTLE RAPIDS.

Improving upper entrance to Hay Lake for a distance of 3,850 feet and width of 600 feet, to a safe navigable depth of 21 feet at low-water stage of 579.9 feet above mean tide at New York.

Contract dated September 16, 1901; Henry Hickler of Sault Ste. Marie, Mich., contractor. Rates: 56 cents per cubic yard, bank measurement, to 21-foot grade, and 28 cents per cubic yard between 21 and 22 foot grades. Material: Sand, clay, stones, bowlders, and hardpan.

Dredging operations were begun September 23, 1901, and finally completed on November 16, 1903. During the past fiscal year three dredges and two derrick boats were variously employed.

The dredges worked 723.9 hours and were delayed 87.8 hours by breakages and other causes. The derrick boats worked 1,005.9 hours and were delayed 210.8 hours, and raised 963 cubic yards of bowlders. The excavated material amounted to 18,876 cubic yards, scow measurement, and was deposited in dumping ground near Bayfield range lights at head of Sugar Island. The west half of channel was opened to navigation on October 27, 1903, then the east half was closed twenty days till completion of work. The specified date for completion of contract was October 31, 1903, but an extension of time was duly asked for and granted.

For all the dredges operated while contract was in force, the number of hours worked totaled 9,070.6, delayed 1,566, and material excavated 330,757 cubic yards, scow measurement. Average progress, 36 cubic yards per working hour per dredge.

The two derrick boats worked 2,061.9 hours, were delayed 463.5 hours, and raised

3,046 cubic yards of bowlders, besides leveling off narrow ridges of gravel and hardpan. Average progress, 1¼ cubic yards per working hour per derrick boat.

The computations for final estimate quantities were made in duplicate, the amounts being 202,525 cubic yards above 21-foot grade plane, 64,857 cubic yards between 21 and 22 foot grade planes, and 129,037 cubic yards either below 22-foot grade plane or outside of side slopes, making a total of 396,419 cubic yards, bank measurement. For the total excavation the computed bank measure exceeded the scow measure by 19 per cent.

The computed amount above 21-foot grade was 61 per cent of the total scow measure.

The cost of excavation, exclusive of engineering and office expenses, was $131,573.96. If the dredges had been hired at rate of $15 per working hour the cost per cubic yard would have been 65 cents, or 9 cents more than contract price.

By previous improvements the channel at upper turn to Hay Lake had been made 18 feet deep, when the water surface was at 579.9, for a width of 600 feet above and 300 feet below the angle. Now, for a distance of half a mile, both sides of the turn, there is a channel depth of 21 feet at lowest stage of water, the width thereof being 1,000 feet above and 600 feet below the angle.

### SECTION 3.—WIDENING AT LITTLE RAPIDS.

Improving channel below islands for a distance of 10,200 feet by widening on east side an additional 150 feet to a depth of 21 feet at low-water stage of 579.5. Contract dated June 5, 1902. Chas. Simono of Two Rivers, Wis., contractor. Rates: 12 cents per cubic yard, bank measurement, to 21-foot grade, and 6 cents per cubic yard between 21 and 22 foot grades. Material: Clay, sand, gravel, and stones.

Work was first begun on June 17, 1902, and finally completed on November 3, 1903. During the past fiscal year the two dredges worked 1,614.7 hours, were delayed 631.2 hours, and excavated 226,875 cubic yards, scow measurement, which was deposited in dumping ground in Baie de Wasig.

Only two dredges were employed on this contract, and they worked 4,947 hours in all, were delayed 1,170 hours, and excavated 954,001 cubic yards, scow measurement. Average progress, 193 cubic yards per working hour per dredge.

The final estimate quantities, determined by duplicate computations, amounted to 729,348 cubic yards, bank measurement, above 21-foot grade, 51,498 cubic yards between 21 and 22 foot grades, and 176,682 cubic yards below 22-foot grade or outside of side slopes of 1 on 2, making a total of 957,528 cubic yards.

The difference between the two methods of measurement was less than one-third of 1 per cent for the total excavation.

The computed amount above 21-foot grade was about 76 per cent of the total scow measure. The removal of ridges and lumps left above grade by the dredges was accomplished by towing a heavy drag over the section for a period of three weeks.

The cost of excavation to the United States, exclusive of engineering and office expenses, was $90,611.64.

The specified contract time of 300 good working days would not have expired before June 10, 1904.

### SURVEYS.

An ice survey was made of sections 1 and 3 in January, 1904. A three-auger party worked five days and took 7,780 soundings, which were mapped and also plotted on cross-section sheets. These soundings were used in connection with those of original survey for computing final estimate quantities.

Examinations were made of sections 1 and 3 by swinging the raft bars suspended at 21-foot grade, and before final acceptance both the sections were entirely covered without striking any obstructions.

There were 16 stakes driven and 3 gauge boards placed for use of contractors.

Careful inspection was constantly made while dredges were at work, full records being kept and daily progress of work duly reported.

Junior Engineer L. P. Morrison had special charge of the Hay Lake work.

Very respectfully, your obedient servant,

JOSEPH RIPLEY,
*Assistant Engineer.*

Lieut. Col. CHAS. E. L. B. DAVIS,
*Corps of Engineers.*

United States Engineer Office,
*Sault Ste. Marie, Mich., July 1, 1904.*

Colonel: I have the honor to submit the following report of operations for improving Middle and West Neebish channels during the fiscal year ending June 30, 1904:

### BAYFIELD SHOAL, ITEM A1.

Improving channel by removal of isolated shoals between canal and Little Rapids so as to secure a navigable depth of 21 feet at low-water stage of 580.3 for a width of 1,000 feet.

A test cut to determine character of material was made through the Bayfield shoal along the north line of channel.

Under emergency contract dated November 7, 1902, Samuel O. Dixon, of Milwaukee, Wis., furnished dredge *No. 8* at rate of $18 per working hour. After excavating 2,785 cubic yards of bowlders, gravel, and sand from an area of 2,000 square yards, while working 119.5 hours, with delays of 52.8 hours, the contract was closed July 23, 1903, as the dredge was not adapted for hard digging.

Under emergency contract dated September 8, 1903, with H. W. Hubbell & Co., of Saginaw, Mich., for dredge *No. 3*, at $15 per working hour, the test cut was completed October 30, 1903.

From an area of 2,700 square yards there was excavated 10,201 cubic yards of material, principally large bowlders embedded in sand.

The dredge worked 349.5 hours, and was delayed by breakages 96.1 hours.

### DEEPENING AT LITTLE RAPIDS.

*Section 1, item B.*—Improving upper entrance channel to Hay Lake from above islands to Frechette Point, a distance of 14,000 feet, for a width of 300 to 450 feet, by deepening to 21 feet at low stage of water of 579.8.

The original improvement of 1892 was for 20 feet depth at mean stage of water of 583.3.

Contract dated April 11, 1904: Charles Simono, of Two Rivers, Wis., contractor. Rates: 17¾ cents per cubic yard, bank measurement, to 21-foot grade, and 8⅞ cents between 21 and 22 foot grades. Material: Clay and sand.

Dredging was begun May 7, 1904. The two dredges employed worked 782.2 hours, were delayed 186 hours, and excavated 161,544 cubic yards, scow measurement, estimated at 113,081 cubic yards, bank measurement, from an area of 181,000 square yards. The material was deposited in the Baie de Wasig dumping ground.

As 46 per cent of the dredging has been done, this section will probably be finished next September, before expiration of three-fifths of specified contract time of 200 good working days.

*Section 2, item B.*—Improving channel between Frechette and Six Mile points, a distance of 12,000 feet, for varying widths of 600 to 1,700 feet, by deepening to 21 feet at low stage of water of 579.4 from former improvement of 20 feet deep at mean stage of 583.

Contract dated April 14, 1904; Lake Erie Dredging Company, of Buffalo, N. Y., contractors. Rates: 13⅞ cents per cubic yard, bank measurement, to 21-foot grade, and $6\frac{15}{16}$ cents between 21 and 22 foot grades. Material: Clay and sand.

One dredge, employed since May 21, 1904, has worked 258.3 hours, lost by breakages 153.2 hours, and excavated 23,765 cubic yards, scow measurement, estimated at 16,636 cubic yards, bank measurement, from an area of 16,200 square yards. The excavated material was deposited in Baie de Wasig.

Only 2 per cent of work has been done during one-eighth of the contract time of 350 working days.

Two additional dredges are soon to be employed.

### DEEPENING NINE MILE POINT SHOALS.

*Section 3, item A3.*—Removal of shoals in mid Hay Lake, covering an area about 1,400 feet long by 500 to 950 feet wide, to a depth of 22 feet at low-water stage of 579.3 from previous improved depth of 21 feet at mean stage of 583.

Contract dated April 11, 1904; H. W. Hubbell & Co., contractors. Rates: 98¾ cents per cubic yard, bank measurement, to 22-foot grade, and 49⅕ cents between 22 and 23 foot grades. Material: Bowlders, stones, clay, sand, and hardpan.

Dredging was begun May 11, 1904, and one dredge has worked 413.7 hours, been delayed 94.5 hours, and excavated 13,310 cubic yards, scow measurement, estimated at 9,317 cubic yards, bank measurement, from an area of 11,300 square yards. The dumping ground was near the Sugar Island shore above Nine Mile Point.

About 17 per cent of the excavation has been done during 21 per cent of the contract time of 200 working days.

### FLATS HAY LAKE ENTRANCE TO WEST NEEBISH.

*Test cut and tug channel.*—Under emergency contract dated November 7, 1902, the Lake Erie Dredging Company, of Buffalo, N. Y., continued work with their elevator dredge at rate of $17.50 per working hour, till November 10, 1903, when the channel, 30 feet wide and 14 feet deep, was finished to deep water below Sand Island.

The dredge worked 1,262.7 hours, was delayed 75.3 hours, and excavated 93,234 cubic yards of silt, clay, and sand, which was deposited 60 feet east of the cut. The channel was extended from cross section 193 to 375, a distance of 9,100 feet, and covered an area of 30,300 square yards.

*Section 1, item F.*—Excavating a channel 300 feet wide at bottom, with side slopes of 1 on 2, for a distance of 32,282 feet, to a depth of 21 feet at low-water stage of 579.3, through flats at foot of Hay Lake, on main part of which the original depth of water was 2 to 10 feet.

Contract dated April 11, 1904; Samuel O. Dixon, of Milwaukee, Wis., contractor. Rates: 12¾ cents per cubic yard, bank measurement, to 21-foot grade, and 6⅜ cents between 21 and 22 foot grades. Material: Clay, silt, and sand.

The first dredge began work May 13, 1904, and three other dredges have been added since. The four dredges have worked in all 822.4 hours, have been delayed 200 hours, and have excavated 164,903 cubic yards, scow measurement, estimated at 115,432 cubic yards, bank measurement, from an area of 49,000 square yards. The excavated material was deposited in dumping ground near Sugar Island shore, above Shingle Bay. About 2 per cent of the work has been done. The contract time for beginning work is September 1, 1904.

### EXCAVATING AT WEST NEEBISH RAPIDS.

*Course 6, item G.*—Construction of a channel 300 feet wide and 22 feet deep at low water of 578.8, for a distance of 13,300 feet through the rapids, with a stone retaining wall along each edge of the rock cut. The water was only a few inches deep over a considerable part of the rock section.

Contract dated April 7, 1904; MacArthur Brothers Company, of Chicago, Ill., contractors. Rates: $1.36 per cubic yard, bank measurement, for rock, and 56 cents for earth to 22-foot grade, and 68 cents for rock and 28 cents for earth between 22 and 23 foot grades; also, $5.50 per square yard of channel surface for retaining walls. Material: Limestone rock, sand, clay, gravel, stones, bowlders, and hardpan.

For convenience of classification all material between cross sections 210 and 1086 will be paid for as rock and all the remainder as earth.

Preliminary work was begun May 16, 1904, and up to date comprises the building of intermediate cofferdams, the starting of the upper cofferdam, the preparation of roadways for traveling cableway, the framing of cableway towers, the erection of boarding houses and store, construction of a dock and assembling plant.

The number of men employed has averaged 96 for 260 working hours. There has been used 775 pounds of dynamite for blasting rock. No estimate for excavation has been submitted. Contract date for beginning operations, July 10, 1904.

### EXCAVATING AT MUD LAKE.

*Section 2, items H, J.*—Making a new channel 300 feet wide and 19,272 feet long, across flats off Winter Point, to a depth of 21 feet, and removal of four small isolated shoals in Mud Lake to a depth of 22 feet below low-water stage of 578.8.

Contract dated April 11, 1904; Chicago and Great Lakes Dredge and Dock Company, contractors. Rates: 12.9 cents per cubic yard, bank measurement, for soft material to 21-foot grade, and 6.45 cents between 21 and 22 foot grades; 98 cents for hard material and $8.25 for rock to the 22-foot grade, and 49 cents for hard material and $4.125 for rock between 22 and 23 foot grades. Material: Clay, sand, silt, stones, bowlders, hardpan, and limestone rock.

Operations were begun June 20, 1904, and one dredge has worked 84.8 hours, been delayed 29.5 hours, and excavated 15,441 cubic yards, scow measurement, estimated at 10,809 cubic yards, bank measurement, from an area of 5,500 square yards. The contract date for beginning work is September 1, 1904.

There were about 300 stakes driven and 25 gauge boards placed for use of the several contractors, and numerous flag buoys placed to mark limits of dumping grounds.

### SURVEYS.

During the month of September, 1903, a detailed survey of the islands and adjacent shore lines of the West Neebish Rapids, from triangulation stations 81–82, at the upper end, to triangulation stations 88–89R, at the lower end, was made and mapped; also of the low, sandy island to the westward of Winter Point. During the month of March a 3-auger party sounded over the area excavated by the dredges working on the test channel through courses 4 and 5, West Neebish channel. There were 3,900 soundings taken, and these were mapped and platted on the cross-section sheets, and computations of the quantities made and deducted from the original amounts.

A survey was made of the shoals off Six Mile Point, from cross section 150 to cross section 269, and from the west channel line to the natural channel bank. Nine thousand six hundred soundings were taken.

Surveys were also made of a portion of the river to the westward of upper entrance to Hay Lake channel, shoal off Johnson & Goss dock, and a portion of the Bayfield shoal dredged over during the season of 1903.

Six thousand six hundred and ten soundings were taken on these three several items.

A line of check levels was run to and from P. B. M. 311, Hay Lake Road, from Charlotte River B. M., and four triangulation stations were occupied and angles read to check location of triangulation station 78R.

Gauges were established at Point Iroquois, Southwest Pier, Northeast Pier, B. M. "A," Little Rapids, Six Mile Point, Hines Landing, Charlotte River, McNaughtons Point, B. M. "A," Middle Neebish, B. M. "K," Middle Neebish, B. M. 13, Sailors Encampment, and a series of simultaneous gauge readings taken latter part of June, 1904, to establish the slope of the river.

Junior Engineer L. P. Morrison was in immediate charge of this part of the work.

Very respectfully, your obedient servant,

Joseph Ripley,
*Assistant Engineer.*

Lieut. Col. Chas. E. L. B. Davis,
*Corps of Engineers.*

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## O O 5.

## IMPROVEMENT OF ST. CLAIR FLATS CANAL, MICHIGAN.

The history of this improvement to June 30, 1896, is outlined in the Report of the Chief of Engineers for that year, pages 2881–2889, no work having been done from 1896 up to 1901, inclusive, the then existing projects having been completed.

The river and harbor act of June 13, 1902, contained new provisions to authorize the construction of a second channel similar to the one already in use and parallel to it, but separated therefrom by a dike of about 100 feet width, so as to provide a channel of 20 feet minimun depth and about 300 feet width from Lake St. Clair up into St. Clair River for ascending boats and a similar channel for descending boats.

The total expenditures under new projects up to June 30, 1903, amount to $3,250.45, leaving $328,908.94 still available for further work.

A survey was made on the ice covering an area about 500 feet wide and 19,000 feet long, the party of 31 being two weeks in the field and taking 27,700 soundings, at a total cost of $1,098, or about 4 cents a sounding.

Plans and specifications for constructing the new channel were prepared, and bids for the work were opened May 18, 1904. The lowest bidder, the M. Rabbitt & Sons Company, was awarded the contract, and will commence work soon.

The general supervision of this work has been in charge of Asst. Engineer E. S. Wheeler.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $330,275.27 |
| June 30, 1904, amount expended during fiscal year for works of improvement | [a]1,366.33 |
| July 1, 1904, balance unexpended | 328,908.94 |
| July 1, 1904, outstanding liabilities | 350.00 |
| July 1, 1904, balance available | [b]328,558.94 |
| July 1, 1904, amount covered by uncompleted contracts | 361,669.88 |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| June 23, 1866 | $80,000 | March 3, 1879 | $3,000 |
| March 2, 1867 | 150,000 | June 14, 1880 | 2,500 |
| July 25, 1868 | 86,000 | August 5, 1886 | 18,750 |
| April 10, 1869 | 142,560 | August 11, 1888 | 75,000 |
| July 11, 1870 | 16,500 | September 19, 1890 | 80,000 |
| March 3, 1871 | 1,500 | June 13, 1902 | 330,000 |
| June 10, 1872 | 4,000 | | |
| March 3, 1873 | 100,000 | Total | 1,094,810 |
| June 18, 1878 | 5,000 | | |

NOTE.—The appropriations of 1852, $20,000, and 1856, $45,000, are not taken account of, for the reason that they did not enter into the improvement of St. Clair Flats Canals, the first having been expended in building a dredge and the second in dredging the north channel of the South Pass. From March 3, 1881, the amounts allotted for operating and care of St. Clair Flats Canal are rendered separately.

### ABSTRACT OF CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract dated June 11, 1904.*

Name of contractor: The M. Rabbitt & Sons Company, Toledo, Ohio.

Amount and character of work: $361,699.88; constructing new channel.

Price per unit: Excavation, 8½ cents per cubic yard, bank measurement; hemlock (sheet piles), $45 per M. feet B. M.; white pine and hemlock (stringers), $42 per M. feet B. M.; oak (waling), $50 per M. feet B. M.; round piles, 40 cents per linear foot; tie-rods, bolts, and spikes, 6 cents per pound.

Date of approval: June 29, 1904.

Date of beginning of work: September 3, 1904.

Date of expiration: September 3, 1906.

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[a] The actual expenditures during the year amounted to $1,550.50, from which the following amounts, collected on account of damages to piers and not heretofore credited, were deducted, viz:

| | |
|---|---|
| Deposited August 30, 1893, account damages, steamer *Jas. Pickands* | $40.97 |
| Deposited June 26, 1898, account damages, steamer *R. P. Ranney* | 93.20 |
| Deposited July 28, 1903, account damages, steamer *J. C. Pringle* | 50.00 |
| | 184.17 |

Making the net expenditures $1,366.33.

[b] This does not include, however, the $85,000 (estimated) diverted from the appropriation for improving St. Marys River at the Falls by act of June 13, 1902.

*Emergency contract dated June 18, 1904.*

Name of contractor: A. J. Dupuis Company, Detroit, Mich.
Amount and character of work: $900 (estimated); hire of pile-driver plant.
Price per unit: $5 per working hour.
Date of beginning of work: June 28, 1904.
Date of expiration: About July 20, 1904.

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### REPORT OF MR. E. S. WHEELER, ASSISTANT ENGINEER.

United States Engineer Office,
*Detroit, Mich., July 5, 1904.*

Colonel: I have the honor to submit the following report of operations under my charge connected with the operating and care of St. Clair Flats Canal for the year ending June 30, 1904:

The canal has been under the immediate charge of Custodian William Mott, with one assistant. Mr. Mott has looked after the enforcement of the rules of the canal in the usual manner. Several unimportant violations of the rules were adjusted by correspondence with the owners and captains of the offending vessels.

The custodian has also had charge of a small working party of five men for three months, and has repaired 700 linear feet of sheet piling along the east side of the east dike. August 11, 1903, a contract was let to A. J. Dupuis Company for rebuilding 190 linear feet of pier revetment on the west side of the east dike. This contract was completed December 12, 1903. A contract was let to Charles Boston & Sons for rebuilding 260 linear feet of pier revetment on the west side of the east dike. This work was begun in May, 1904, and is now about two-thirds completed. This contract is still in force.

October 23, 1903, contracts were let to A. J. Dupuis Company and the Candler Dock and Bridge Company for time work with one pile-driving plant. The former contract was completed December 4, making twenty-six days' work with one pile-driving plant, and the latter December 5, making twenty-six days' work with one pile-driving plant. The work done under these two contracts consisted in repairing the pile revetment around the lower end of the east dike.

The amount of commerce passing through St. Clair Flats Canal has been compiled in the same manner as last year. The total freight passing St. Clairs Flats Canal during the season of 1903 is found to be 41,888,134 tons of 2,000 pounds each.

Final plans and estimates for an office building, custodian's dwelling, and boathouse have been prepared by Junior Engineer H. R. Allen.

Very respectfully,

E. S. Wheeler,
*Chief Assistant Engineer.*

Lieut. Col. Chas. E. L. B. Davis,
*Corps of Engineers.*

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## O O 7.

## IMPROVEMENT OF DETROIT RIVER, MICHIGAN.

The river and harbor act of March 3, 1899, authorized expenditures for this improvement to the extent of $661,500, all of which has since been appropriated under the sundry civil acts of June 6, 1900, March 3, 1901, and June 28, 1902.

The river and harbor act of June 13, 1902, appropriated $500,000 for carrying out a project of improvement designated as "Plan A," of which amount the Secretary of War was authorized to expend $10,000 in the river north and west of Grosse Isle for the deepening of the channel to Wyandotte, Mich., with the proviso that contracts may be entered into for such materials and work as may be necessary to prosecute said project, not to exceed in the aggregate $1,750,000.

Operations under the old and new projects were continued during the fiscal year as follows:

Contract work was commenced in June, 1900, to widen Lime Kiln Crossing 180 feet to the westward, with a depth of 21 feet at a stage of 572.6, and was completed October 27, 1903, the total amount of material removed being 101,072 cubic yards, of which 1,540 cubic yards were removed during the fiscal year, the material being limestone rock requiring drilling and blasting.

A triangular area at the south end of the crossing, 600 feet long and 180 wide, was deepened from 16 to 21 feet under a contract which was completed October 27, 1903, the total amount of material removed being 5,502 cubic yards, 30 of which were removed during the fiscal year.

The remaining portions of the Lime Kiln Crossing still have a least depth of but 19 feet at a stage of 572.6.

Contract work commenced in 1901 for deepening the channel through Amherstburg reach to a depth of 21 feet at a Lake Erie stage of 571.5, for a width of 500 feet, was completed October 14, 1903, the total amount of material removed being 98,331.9 cubic yards, of which 18,891.3 cubic yards were removed during the fiscal year, the material being limestone rock requiring drilling and blasting.

New contracts provide for a 21-foot depth at a stage of 570.8 and least width of 600 feet, for the entire stretch from above Ballards Reef channel to below Detroit River light.

The project known as the 1902 project, by which the channel lines are to be changed from those of the earlier projects in order to straighten the channel and at the same time to take advantage of former improvements, is now about to be carried out, the contract for the work having already been let, but no work was done during the fiscal year. This contract requires the removal of about 140,000 cubic yards of mainly limestone bed rock.

Under contract, dredging was commenced on May 24, 1904, on the Amherstburg reach and Hackett Range, the object being to provide a clear depth of 21 feet for widths of 300 to 600 feet, straightening the old channel lines and taking advantage of work already completed, involving the removal of some 500,000 cubic yards. At the close of the fiscal year 7,500 cubic yards had been removed, consisting of sand, clay, and bowlders overlying the bed rock.

Of the $10,000 authorized for deepening the channel to Wyandotte, Mich., nearly the entire amount was expended, work under contract commencing May 17, 1904, and ending June 27, 1904, 65,568 cubic yards of material being removed.

In addition to the contract work a derrick scow and diving plant belonging to the United States were operated by hired labor from July 1 to November 27, 1903, and from May 1 to June 30, 1904, removing 775 cubic yards of bowlders over an area of some 200,000 square yards from the channel between the head of Ballards Reef and Bar Point, wherever the sweeping raft disclosed points having less than the required 21 feet depth.

Sweeping by raft over channel areas and surveys, both general and special, were continued, and water-gauge readings were automatically recorded at Amherstburg during the year and the results transmitted to the Lake Survey office.

These works were under the local supervision of Asst. Engineer Chas. Y. Dixon, to whose detailed report attention is invited, particularly to the present condition of the channel as the result of past improvements, a condensed statement of which is not attempted.

The commerce through the Detroit River during the calendar year 1903 amounted to over 46,000,000 freight tons, as shown by the subjoined report of Mr. Wheeler.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $990,717.20 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 81,358.98 |
| July 1, 1904, balance unexpended | 909,358.22 |
| July 1, 1904, outstanding liabilities | 14,089.55 |
| July 1, 1904, balance available | 895,268.67 |
| July 1, 1904, amount covered by uncompleted contracts | 1,234,418.47 |
| Amount (estimated) required for completion of existing project | 800,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 450,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| June 23, 1874 | $25,000 | June 3, 1896 | $30,000 |
| June 18, 1878 | 100,000 | March 3, 1899 | 100,000 |
| March 3, 1879 | 50,000 | June 6, 1900 (sundry civil act) | 200,000 |
| June 14, 1880 | 50,000 | March 3, 1901 (sundry civil act) | 325,000 |
| March 3, 1881 | 50,000 | June 13, 1902 | 500,000 |
| August 2, 1882 | 60,000 | June 28, 1902 (sundry civil act) | 136,500 |
| July 5, 1884 | 200,000 | March 3, 1903 (sundry civil act) | 450,000 |
| August 5, 1886 | 37,500 | | |
| August 11, 1888 | 130,500 | | |
| July 13, 1892 | 30,000 | | |
| August 18, 1894 | 30,000 | Total | 2,504,500 |

ABSTRACT OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract dated May 18, 1900.*

Name of contractor: James B. Donnelly, Buffalo, N. Y.

Amount and character of work: $189,259.01; dredging at Lime Kiln Crossing.

Price per unit: $2.27 per cubic yard, bank measurement (full rate), and $1.13½ per cubic yard, bank measurement (half rate).

Date of approval: June 4, 1900.

Date of beginning of work: June 23, 1900.

Date of expiration (as extended): indefinite. Completed October 27, 1903.

*Contract dated June 6, 1901.*

Name of contractor: M. Sullivan, Detroit, Mich.

Amount and character of work: $284,724.59; dredging Amherstburg Reach.

Price per unit: $2.90 per cubic yard, bank measurement.

Date of approval: June 27, 1901.

Date of beginning of work: July 5, 1901.

Date of expiration (as extended): indefinite. Completed October 14, 1903.

*Contract dated June 6, 1902.*

Name of contractor: Donnelly Contracting Company, Buffalo, N. Y.

Amount and character of work: $19,329.01; dredging at south end of Lime Kiln Crossing.

Price per unit: $4.21 per cubic yard, bank measurement (full rate), and $2.10½ per cubic yard, bank measurement (half rate).

Date of approval: July 3, 1902.

Date of beginning of work: August 15, 1902.

Date of expiration: about July 10, 1903. Completed October 27, 1903.

*Emergency contract dated June 30, 1903.*

Name of contractor: M. Sullivan, Detroit, Mich.

Amount and character of work: $3,140; hire of tug *Quickstep*.

Price per unit: $600 per calendar month.

Date of beginning of work: July 10, 1903.

Date of expiration: about December 10, 1903. Completed December 1, 1903.

*Contract dated April 5, 1904.*

Name of contractor: G. H. Breymann & Bro., Toledo, Ohio.

Amount and character of work: $430,625 (estimated); dredging section 2, Lime Kiln Crossing.

Price per unit: $3.25 per cubic yard, bank measurement (full rate), and $1.62½ per cubic yard, bank measurement (half rate).

Date of approval: April 14, 1904.

Date of beginning of work: June 20, 1904.

Date of expiration: (400 good working days) about July 7, 1906.

*Emergency contract dated April 15, 1904.*

Name of contractor: J. H. & D. Sullivan, Detroit, Mich.

Amount and character of work: $3,444 (estimated); hire of tug *Quickstep*.

Price per unit: $574 per calendar month.

Date of beginning of work: April 25, 1904.

Date of expiration: about October 25, 1904.

*Contract dated May 5, 1904.*

Name of contractor: G. H. Breymann & Bro., Toledo, Ohio.

Amount and character of work: $9,000 (estimated); dredging channel to Wyandotte, Mich.

Price per unit: $20 per working hour.

Date of approval: May 19, 1904.

Date of beginning of work: June 23, 1904.

Date of expiration: indefinite. Completed June 27, 1904.

*Contract dated May 31, 1904.*

Name of contractor: M. Sullivan, Detroit, Mich.

Amount and character of work: $804,000 (estimated); dredging section 4, Amherstburg Reach and Hackett Range.

Price per unit: $2.40 per cubic yard, bank measurement (full rate), and $1.20 per cubic yard, bank measurement (half rate).

Date of approval: June 13, 1904.

Date of beginning of work: August 15, 1904.

Date of expiration: (500 good working days) about May 15, 1907.

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## REPORT OF MR. R. S. WHEELER, ASSISTANT ENGINEER.

United States Engineer Office,
*Detroit, Mich., April 6, 1904.*

Colonel: I have the honor to submit the following report upon the commerce using the Detroit River and also the St. Clair Flats Canal.

The compilation has been from data similar to that used in 1902, viz: The marine post-office record of vessels passing through Detroit River and the custom-house record of vessels stopping in Detroit River.

The Detroit postmaster, Mr. F. B. Dickerson, has permitted the record of vessels passing Detroit River to be copied.

The collectors of customs at Detroit, Windsor, and Amherstburg have permitted the records of vessels stopping in Detroit River to be copied. This gives a complete list of boats using Detroit River.

After the list was completed the net registered tonnage was copied from the American and Canadian "Blue Books," and summed. This gives the total net registered tonnage using Detroit River. The ferryboats plying between Detroit and Windsor and Detroit and Belle Isle are not included.

The passages are collected and summed up as follows:

| Date. | Number of vessels. | Net registered tons. | Date. | Number of vessels. | Net registered tons. |
|---|---|---|---|---|---|
| 1903. | | | 1903. | | |
| March | 326 | 72,880 | September | 4,206 | 4,749,499 |
| April | 2,131 | 2,147,001 | October | 3,690 | 4,494,851 |
| May | 4,583 | 5,378,742 | November | 2,703 | 3,157,591 |
| June | 4,677 | 5,809,045 | December | 564 | 669,729 |
| July | 5,163 | 5,847,859 | | | |
| August | 5,070 | 5,626,599 | Total | 33,113 | 37,453,796 |

The preceding results are compiled from official lists which are required by law to be accurate and complete. The derived net registered tonnage is entirely trustworthy, and is probably not in error so much as 1 per cent.

The net registered tonnage is 1,874,893 tons less than for the season of 1902. This decrease is not unexpected, a similar decrease having been observed at St. Marys Falls Canal.

No record is kept of the freight actually carried through the Detroit River. It is therefore not possible to determine the actual freight tonnage with the accuracy that has been obtained for net registered tonnage. A close approximation of the freight tonnage was obtained for the season of 1902 by comparison with the tonnage at St. Marys Falls Canal, at which place the records of both the net registered tonnage and actual freight tonnage are kept. It is found that in recent years (from 1897 to 1902) the actual freight, in tons of 2,000 pounds each, at St. Marys Falls Canal has exceeded the net registered tonnage by from 12 to 15 per cent; in 1902 the ratio of 12½ per cent was used. For 1903 the ratio is 25 per cent. This large change in ratio is explained as follows: In 1902 the coal market was very much disturbed, and but little coal went up the Lakes, consequently there was a shortage in coal which was made up in 1903. An examination of the St. Marys Falls records shows that the coal was 2,000,000 tons more in 1903 than it was in 1902, this being upfreight did not increase the registered tonnage at all, and is sufficient to account for nearly all of the change in the ratio between freight and registered tonnage.

Again, the available depth of water in the channels was about 0.4 foot greater in 1903 than in 1902, allowing the heavy-draft boats to load deeper. These two causes are amply sufficient to explain the excess in the ratio of 1903 over that of 1902.

The freight tonnage at St. Marys Falls Canal for the season of 1903 being 25 per cent greater than the net registered tonnage, we may apply this ratio to the net registered tonnage of the Detroit River. This gives 46,817,245 freight tons of 2,000 pounds each for the Detroit River for the season of 1903. This estimate of actual freight depends upon the assumption that the ratio between actual and registered tonnage in the Detroit River is the same as that found at St. Marys Falls Canal, therefore it is only approximate and does not have the accuracy of the determination of the net registered tons; it is, however, believed that the similarity of the business in the Detroit River to the business through the St. Marys Falls Canal is such that the error can not exceed 4 per cent.

The commerce using St. Clair Flats Canal is very nearly the same as that of the Detroit River. There are, however, some small differences, as follows: It is found from the customs-house records that 3,963,289 net registered tons do not go through the canal, but turn around and go back down the river. This should be subtracted from the Detroit River tonnage. There is a small amount of business done at Lake St. Clair ports which does not reach the Detroit River and of which we have no actual record. It is estimated by the custodian to aggregate 20,000 net registered tons during the season. This should be added to the Detroit River tonnage. Making these corrections, the total net registered tons passing St. Clair Flats Canal during the season of 1903 is found to be 33,510,507 net registered tons, and 41,888,134 freight tons of 2,000 pounds each.

The work of compiling these statistics has been considerable, and has been done by Junior Engineers H. R. Allen and Bamlet Kent and Master C. L. Wilson, Custodian Wm. Mott, and Steam Engineer A. R. Crook.

### SUMMARY.

*Detroit River.*

| | |
|---|---|
| Net registered tons | 37,453,796 |
| Freight in tons of 2,000 pounds | 46,817,245 |
| Number of vessel passages | 33,113 |

*St. Clair Flats Canal.*

| | |
|---|---|
| Net registered tons | 33,510,507 |
| Freight in tons of 2,000 pounds | 41,888,134 |

Very respectfully, your obedient servant,

E. S. Wheeler,
*Chief Assistant Engineer.*

Lieut. Col. Chas. E. L. B. Davis,
*Corps of Engineers.*

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### REPORT OF MR. CHAS. Y. DIXON, ASSISTANT ENGINEER.

United States Engineer Office,
*Detroit, Mich., July 5, 1904.*

Colonel: I have the honor to submit the following report of operations under my charge during the fiscal year ending June 30, 1904, connected with the improvement of the Detroit River:

*Section 2, Lime Kiln Crossing.*—The object of this improvement was to secure a channel depth of 21 feet (at a Lake Erie stage of 572.6 feet above mean tide at New York) throughout the west 180 feet of a 600-foot channel along the Lime Kiln Crossing range. The length of channel covered by this contract was 3,000 feet, and the least depth prior to improvement was about 14 feet. This work was performed by James B. Donnelly, of Buffalo, N. Y., under formal contract dated May 18, 1900, the contract price being $2.27 per cubic yard, bank measurement, for material above the 21-foot grade, and $1.135 per cubic yard for material removed from between the 21 and 23 foot grades.

Work under this contract was commenced on June 23, 1900, and the contract time expired on November 30, 1901, but the work then being incomplete the time limit was waived, the contractor agreeing to continue and complete the work at the contract prices, using such plant as might be approved by the engineer officer in charge.

Operations were continued during the fiscal year until October 27, 1903, when the work was completed. The plant used was as follows: One drill boat equipped with three drills (18 hours worked), one dredge (18 hours worked), one derrick scow (827 hours worked), one tug, and the necessary dump scows.

The amount of material removed during the fiscal year was 1,540 cubic yards, bank measurement. The total amount of material removed under this contract was 66,026.3 cubic yards, full rate (above 21-foot grade); 35,045.5 cubic yards, half rate (between 21 and 23-foot grades), and 20,635.2 cubic yards, no payment (below 23-foot grade); and the amount earned by the contractor was $189,656.34.

The material removed consisted mainly of limestone bedrock, which required to be drilled and blasted before being removed. The holes were generally drilled at the corners of 5-foot squares, and during the fiscal year the number of holes drilled was 66, being 330 linear feet, and the number of pounds of dynamite used was 525.

An examination of the area improved under this contract by means of bars suspended from the sweeping raft to the 21-foot grade was completed on October 27, 1903, on which date the work was accepted and the contract closed. The survey on which was based the final estimate was completed during November, 1903, and the final estimate was submitted on November 21, 1903.

*Item A, widening at the south end of Lime Kiln Crossing.*—The object of this improvement was the deepening to 21 feet (at a Lake Erie stage of 571.5 feet) of a triclear depth of 22.1 feet, and within the east part (about 200 feet width) there is a clear depth of 19.5 feet, and for the remaining part of this course (about 4,500 feet) there is a clear depth of 22.1 feet for a width of 500 feet, with a contract in force (work now in progress) providing for a widening to 600 feet and deepening to 22.8 feet. From the south end of Amherstburg reach to about 1½ miles south of Bois Blanc Island there is a clear depth of 19.3 feet for from 500 to 600 feet width, with a contract in force providing for a deepening to 22.8 feet for a width of 600 feet and length of 1,000 feet at the north end, and for the west 300 feet throughout the southern portion. From about 1½ miles south of Bois Blanc Island to about 1 mile south of Bar Point there is a clear depth of 21 feet for 600 feet width, and from about 1 mile south of Bar Point to Detroit River light-house there is a clear depth of 20 feet for a width of 800 feet.

*Surveys.*—During July, October, and November, 1903, soundings were taken at the corners of 10-foot squares from the sweeping raft, when anchored in the desired positions, for the purpose of determining the condition of the dumping grounds (July survey), and for the purpose of computing the amounts of material removed under contracts for excavation at Limekiln Crossing and at Amherstburg reach (October and November survey). The total number of soundings thus taken was 50,110, at a cost of $1,352.40, being 2.7 cents per sounding.

During December, 1903, and January, 1904, ice surveys were made covering the area improved at Amherstburg reach for the purpose of computing the final estimate, and at Bar Point shoals for the purpose of computing estimates for future work. These surveys consisted in taking soundings at 10-foot intervals along cross sections 10 feet apart at Amherstburg reach, and at 10-foot intervals along cross sections 20 feet apart at Bar Point shoals. The number of soundings taken was 60,710, at a cost of $1,786, being 2.9 cents per sounding.

During February, 1904, an ice survey was made for the purpose of correcting the charts to show the present condition between the channel and the west shore at the mouth of the Detroit River. This survey consisted in the taking of soundings at 50-foot intervals along cross sections 500 feet apart. The number of soundings taken was 11,400, at a cost of $601.50, being 5.3 cents per sounding.

*Water-gauge readings.*—The automatic water gauge at the mouth of the Detroit River was attended to regularly during the year, and the record derived therefrom was reduced. The following are the elevations (levels of 1903), above mean tide at New York, of the mean stage for the several months:

| | Feet. | | Feet. |
|---|---|---|---|
| July, 1903 | 573.20 | January, 1904 | 571.57 |
| August, 1903 | 573.01 | February, 1904 | 571.69 |
| September, 1903 | 572.84 | March, 1904 | 572.22 |
| October, 1903 | 572.40 | April, 1904 | 573.31 |
| November, 1903 | 571.87 | May, 1904 | 573.61 |
| December, 1903 | 571.66 | June, 1904 | 573.74 |

The highest stage of water during the year was 575.27, on May 31, 1904, and the lowest stage was 569.89, on December 13, 1903. The month of greatest fluctuation was September, 1903 (3.89 feet), and the month of least fluctuation was June, 1904 (1.35 feet). The greatest fluctuations during a period of twenty-four hours were as follows: 2.95 feet, on July 18, 1903; 2.93 feet, on November 11, 1903, and 3.57 feet, on November 12, 1903.

Very respectfully, your obedient servant,

Chas. Y. Dixon,
*Assistant Engineer.*

Lieut. Col. Chas. E. L. B. Davis,
*Corps of Engineers.*

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## O O 8.

## REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

*Wreck of steamer T. D. Stimson.*—This steamer was burned June 30, 1903, and sank near the Riverside Hotel, St. Clair Flats. August

5, 1903, a contract was made for the removal of the wreck for $300, and August 13, 1903, the work was completed.

*Sunken anchor.*—An obstruction was reported in the channel about 1 mile above the Port Huron light-ship. The U. S. S. *Hancock* found and removed this obstruction August 8, 1903, it proving to be a large anchor of English make bearing the date of 1819. By authority of the Secretary of War, this anchor has been placed in Belle Isle Park, Detroit.

*Wreck of schooner Champion.*—This vessel was sunk in St. Clair River July 13, 1903, near the head of Russells Island. Attempts were made to drag the wreck out of the channel, but proving unsuccessful, a contract was made in August, 1903, for the removal of the wreck for $950, and the work completed September 2, 1903.

*Wreck of the steamer John N. Glidden.*—This steamer was sunk by colliding with the steel barge *Magna* in the St. Clair Flats Canal, Michigan, on October 9, 1903. Operations for the removal of the wreck were begun at once and continued until the close of navigation, at which time about two-thirds of the wreck had been removed. In December, 1903, a contract was made for the removal of the remaining portions of the wreck for $2,300. On April 17, 1904, the contractor went up to the canal with his wrecking plant, and on May 4, 1904, the removal of the wreck was reported as complete. The total cost of the removal was $41,837.

*Wreck of the steamer Minnesota.*—This vessel burned and sank November 17, 1903, in about 40 feet of water 1,500 to 2,000 feet below Grande Pointe Hotel wharf, in the St. Clair River. As the wreck lies in Canadian waters, it would seem that its removal ought to be done by the Dominion government. Correspondence with the department having charge of such matters developing the fact that considerable delay would of necessity arise, and as the obstruction was a serious one to the navigation interests of the United States, an allotment of $6,000 was obtained in December, 1903, for the removal of the wreck, but at present the Canadian government is engaged in its removal. When last heard from the contractor had removed the cargo of coal and the engines and boiler were ready for removal. Work of removal was in progress at the close of the fiscal year.

*Sunken light-house cribs.*—Four wooden cribs filled with stone originally formed the substructure of beacon lights on the ship channel range at the lower end of Lake St. Clair. These lights, having been replaced by floating lights, were abandoned by the light-house authorities some time previous to 1900. The ice soon overturned these cribs, and, lying close to the channel edge in depths varying from 16 to 19¼ feet of water, with but 2 to 8 feet of water over them, they formed dangerous obstructions, particularly to craft of light draft. The Light-House Establishment not being able to remove these cribs without special legislation, authority was granted by the Secretary of War, the cost of removal to be paid from the appropriation for the improvement of the ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo. Work was commenced May 21 and the last crib removed May 28, 1904.

*Sunken crib.*—A crib was built in the sixties on the north side of St. Marys River channel just above Sailors Encampment for the purpose of supplying cord-wood fuel to tugboats, and in the course of time, being abandoned, had sunken and become a dangerous obstruction to navigation.

Its removal was authorized June 6, 1903, at a total cost of $900, and its removal effected in August, 1903.

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### ABSTRACT OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Emergency contract, dated August 5, 1903.*

Name of contractor: John S. Quinn, Detroit, Mich.
Amount and character of work. $950; removal of wreck of schooner *Champion*.
Price per unit: Lump sum of $950.
Date of beginning of work: August 15, 1903.
Date of expiration: September 4, 1903. Completed September 2, 1903.

*Emergency contract, dated August 5, 1903.*

Name of contractor: Louis D. Hawley, Detroit, Mich.
Amount and character of work: $300; removal of wreck of steamer *T. D. Stimson*.
Price per unit: Lump sum of $300.
Date of beginning of work: August 6, 1903.
Date of expiration: August 25, 1903. Completed August 13, 1903.

*Emergency contract, dated December 18, 1903.*

Name of contractor: H. W. Baker, Detroit, Mich.
Amount and character of work: $2,300; removal of remainder of wreck of steamer *John N. Glidden*.
Price per unit: Lump sum of $2,300.
Date of beginning of work: January 17, 1904 (weather permitting).
Date of expiration: Indefinite. Completed May 10, 1904.

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## O O 9.

## PRELIMINARY EXAMINATION AND SURVEY OF BACK CHANNEL IN DETROIT RIVER FROM MAIN SHIP CHANNEL TO WYANDOTTE, MICHIGAN.

[Printed in House Doc. No. 160, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 12, 1903.*

SIR: I have the honor to submit herewith for transmission to Congress copies of reports dated January 16 and October 12, 1903, with map,[a] by Maj. W. H. Bixby, Corps of Engineers, upon preliminary examination and survey, respectively, for "channel in Detroit River 20 feet deep from main channel to Wyandotte," Mich., made in pursuance of the provisions of the river and harbor act approved June 13, 1902.

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[a] Not reprinted; printed in House Doc. No. 160, Fifty-eighth Congress, second session.

The item in the law contemplates securing a better connection between the main channel of Detroit River and the channel back of Grosse Isle, which lies in front of Wyandotte. The plan of improvement presented by Major Bixby provides for securing this connection by straightening and enlarging the upper and lower entrances, by means of dredging, to a depth of 20 feet and minimum width of 300 feet, at an estimated cost of $57,500, it being proposed to start such work with the $10,000 made available for the purpose in the item of appropriation for improvement of Detroit River, in the river and harbor act approved June 13, 1902.

These reports have been referred for consideration by the Board of Engineers for Rivers and Harbors, as provided in sections 3 and 14 of said act, and attention is respectfully invited to its report of December 4, 1903.

The local and division engineers and the Board are of opinion, in which I concur, that it is desirable for the United States to undertake the proposed work to the extent herein outlined.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF BACK CHANNEL IN DETROIT RIVER FROM MAIN SHIP CHANNEL TO WYANDOTTE, MICH.

ENGINEER OFFICE, UNITED STATES ARMY,
*Detroit, Mich., January 16, 1903.*

GENERAL: Complying with the requirements of the river and harbor act of June 13, 1902, and your instructions of June 23 and August 30, I have the honor to submit the following report on a preliminary examination of "channel in Detroit River 20 feet deep from main channel to Wyandotte," Mich.

Wyandotte, Mich., is on a back channel of the Detroit River, such back channel being about 15 miles long, measured from deep water at its northern end or head in the main river opposite Ecorse down to deep water at its southern end, where the Detroit River empties into Lake Erie. From the main channel of the Detroit River down this back channel to Wyandotte, a distance of about 3 miles, there is already a navigable channel way of more than 20 feet depth, over a width varying from about 300 feet to about 1,000 feet. This back channel is, furthermore, already connected to the main channel of Detroit River by a secondary channel way extending from the main river opposite the lower and southern end of Wyandotte along the east side of the upper and northern end of Grosse Isle to the back channel at the upper and northern end of Wyandotte, this secondary channel way being about 1.5 miles long, with a depth already more than 20 feet, over a channel width varying from about 400 to about 800 feet. From Wyandotte down the back channel about 5 miles, to the Michigan Centrail Railroad bridge, the back channel is also already fully 20 feet connection with and as part of the already authorized work in this back channel; and further special allotments for such survey are therefore considered unnecessary.

Very respectfully, your obedient servant,

W. H. BIXBY,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., January 17, 1903.*

Respectfully forwarded to the Chief of Engineers with the recommendation that a survey of the locality be authorized as contemplated in paragraph 9 of this report.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 3, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., February 19, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on the preliminary examination of "channel in Detroit River 20 feet deep from main channel to Wyandotte," and the indorsement of the division engineer thereon.

The river and harbor act of June 13, 1902, appropriated $500,000 for the improvement of Detroit River from Detroit to Lake Erie, "of which amount the Secretary of War may expend $10,000 in the said river north and west of Grosse Isle for the deepening of the channel to Wyandotte, Michigan."

The district officer and division engineer recommend that a survey to cost about $500 be made from the $10,000 thus appropriated, on which to base a detailed project for the expenditure of the balance of the available funds. The Board concurs in the views of these officers, and recommends that the survey be made from funds appropriated for the improvement.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 27, 1903.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of channel in the Detroit River from the main channel to Wyandotte, Mich., authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,
*March 4, 1903.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 4, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 4, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

At its session of this date the Board of Engineers for Rivers and Harbors had under consideration the accompanying report of the district officer on a survey of "channel in Detroit River 20 feet deep from main channel to Wyandotte," Mich., and the indorsement of the division engineer thereon.

The act ordering this examination contemplated securing a better connection between the main channel in Detroit River and the channel back of Grosse Isle, which lies in front of Wyandotte. The district officer proposes to secure this connection by straightening and enlarging (1) the lower entrance along the east side of Point Hennepin, and (2) the upper entrance between Grassy Island and Mud Island, as shown on accompanying tracing. It is proposed to start the work with the $10,000 made available for the purpose by the act of June 13, 1902.

At present the greater part of the tonnage originating at or destined for the towns of Trenton and Wyandotte, amounting annually to nearly 2,000,000 tons, is handled by rail, but it is claimed that improved navigation facilities will induce large shipments by water and be of great benefit to commerce.

The estimated cost of the work as proposed by the district officer is $57,500, of which amount there is on hand, as stated above, $10,000.

Comparing the present and prospective commerce with the cost of the work, the Board is of opinion that it is desirable for the United States to undertake the improvement of a "channel in Detroit River 20 feet deep from main channel to Wyandotte," Mich., as proposed by the district officer, at a cost of $57,500.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## SURVEY OF BACK CHANNEL IN DETROIT RIVER FROM MAIN SHIP CHANNEL TO WYANDOTTE, MICH.

ENGINEER OFFICE, UNITED STATES ARMY,
*Detroit, Mich., October 12, 1903.*

GENERAL: I have herewith to submit a report upon the survey of the channel in Detroit River 20 feet deep from the main channel to Wyandotte, Mich., as called for by the provisions of the river and harbor act of June 13, 1902, authority of the Secretary of War dated March 4, 1903, and the instructions of the Engineer Department dated March 10, 1903.

Wyandotte, Mich., is located on one of the largest back channels of the Detroit River, close to the southern end of the city of Detroit, opposite the head of Grosse Isle, and lies within a portion of Detroit River covered by official harbor lines already established and approved by the War Department. The manufacturing interests of Detroit are already extending their establishments down the back channel of Detroit River to Wyandotte, and even beyond; so that the portion of Detroit River covered by this survey is entitled to consideration, not only from the local commercial interests of Wyandotte, but also from the propective interests of a greater Detroit.

Two reports on the preliminary examination of this channel have already been submitted; one by my predecessor, Col. G. J. Lydecker, dated October 20, 1900, as called for by the river and harbor act of June 6, 1900, under the heading "Detroit River [Michigan]: With a view to obtaining a sufficient depth of water in the channel on the west side of Grosse Isle," and as printed on pages 3208–3212, Annual Report for 1901, as well as in House Document No. 82, Fifty-sixth Congress, second session; a second by myself, under date of January 16, 1903, as called for by the river and harbor act of June 13, 1902. Both these reports go into considerable detail regarding the extent of commercial interests, present and prospective, involved; and they are herewith referred to for such details. Both examination reports express practically the opinion that an improvement of this channel would not benefit general commerce proportionately to its cost, and that a limited improvement for the benefit of Wyandotte and lower Detroit harbors was all that could be considered worthy of being undertaken by the General Government. My preliminary examination report of January 16, 1903, which led to an authority for the present survey, expressed the opinion that the only improvement left to me for present consideration is that of the two existing entrances to the back channel; one, the lower entrance along the upper side of Point Hennepin, and the other the upper entrance between Mud Island and Grassy Island, opposite Ecorse; and that it would be proper and advantageous to widen and straighten these channels so as to give easy entrance to heavy freighters. The present survey has, therefore, been restricted to the consideration of such an improvement.

The results of such survey are shown on the inclosed map (scale 1:10,000), embodying the results of lake surveys of former years with new hydrographic surveys made in 1901, 1902, 1903. In connection with the soundings made in 1903 to obtain the present depth of water through these channels, other soundings have been made to determine the nature of the soil of the river bottom.

As the commerce expected to make use of this channel for many years will be limited in extent, a 300-foot width of channel is all that is considered necessary, this width being as great as that of the St. Clair Flats Canal. As will be seen from the map, large freighters entering or leaving the harbor of Wyandotte through the lower entrance along the east side of Point Hennepin must at present find great difficulty in turning the sharp corner around such point. For such reasons it is proposed to round off this point considerably, and to start such work by means of the $10,000 which the river and harbor act of June 13, 1902, authorized the Secretary of War to take from the Detroit River appropriation of that act, and to expend in such river north and west of Grosse Isle for the deepening of the channel to Wyandotte. As these channels are to be used by heavy freighters, it is furthermore desirable that the improved channel ways be made straight and so located as to admit of being readily marked by range lights. Channels laid out in accordance with the above views are indicated on the accompanying map, being marked A–B for the upper entrance, between Mud Island and Grassy Island, and C–D for the lower entrance, between Mamajuda shoal and Point Hennepin.

The results of the surveys of the present year indicate soft material everywhere, entirely free from rock and very easy to dredge. The cost of excavation of the two 300-foot width channels, A–B slightly widened at its lower end, and C–D widened greatly at its upper end, by rounding off the point C, is estimated as follows:

| | Yards. | | |
|---|---|---|---|
| Channel A–B, dredging | 90,000 | | |
| Point C, dredging | 160,000 | | |
| Channel C–D, dredging | 150,000 | | |
| Total | 400,000, | at 12½ cents per yard | $50,000 |
| Superintendence and contingencies, 15 per cent | | | 7,500 |
| Total | | | 57,500 |

As $10,000 is already available for such work, there will be necessary only a further appropriation of $47,500. Such work is recommended herewith.

An increase of the above-described channels to 600 feet width, which is that adopted for Detroit River proper, can easily be made at any future date when the commercial interests justify such work; but it will require a further expenditure of about $23,000 for dredging

160,000 yards at A–B, and of $103,500 for dredging 720,000 yards at C–D, in addition to possibly one or two thousand dollars for the purchase of property behind the already established harbor line at Point Hennepin, in all about $128,000 additional; but in my opinion the commercial interests of to-day do not justify such expenditure, and such widening is therefore not recommended at present.

Very respectfully, your obedient servant,

W. H. Bixby,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Office Division Engineer, Northwest Division,
*Chicago, Ill., October 27, 1903.*

Respectfully forwarded to the Chief of Engineers, U. S. Army, recommended for approval.

O. H. Ernst,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

# APPENDIX P P.

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## IMPROVEMENT OF RIVERS AND HARBORS ON LAKE ERIE IN THE STATE OF OHIO.

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*REPORT OF MAJ. DAN C. KINGMAN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

### IMPROVEMENTS.

1. Toledo Harbor, Ohio.
2. Port Clinton Harbor, Ohio.
3. Sandusky Harbor, Ohio.
4. Huron Harbor, Ohio.
5. Vermilion Harbor, Ohio.
6. Black River Harbor (Lorain), Ohio.
7. Cleveland Harbor, Ohio.
8. Fairport Harbor, Ohio.
9. Ashtabula Harbor, Ohio.
10. Conneaut Harbor, Ohio.
11. Removing sunken vessels or craft obstructing or endangering navigation.

### EXAMINATIONS AND SURVEY.

12. Huron Harbor, Ohio.
13. Portage River, Ohio.
14. Rocky River Harbor, Ohio.
15. Sandusky River, Ohio.
16. Vermilion Harbor, Ohio.

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ENGINEER OFFICE, UNITED STATES ARMY,
*Cleveland, Ohio, July 19, 1904.*

GENERAL: I have the honor to forward herewith annual reports for work in my charge for fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, U. S. A.*

LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for dredging in straight channel through Maumee River and Bay and for constructing a dike between turn-out channels, Toledo Harbor, Ohio.*

Name of contractor: The Lydon & Drews Company, Chicago, Ill.
Date of contract: July 21, 1899.
Date of approval: September 23, 1899.
Date of commencement: May 1, 1900.
Date of completion: Continuous contract.

### COMMERCIAL STATISTICS.

The following statistics for the year 1903 relative to the commerce of the harbor of Toledo, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coal | 52,583 | Coal | 2,093,339 |
| Fish | 748 | Corn | 54,516 |
| Flaxseed | 23,470 | Flour | 11,017 |
| Iron ore | 856,290 | Merchandise | 33,100 |
| Lath | 4,164 | Timber | 20,143 |
| Lumber | 116,681 | Wheat | 52,620 |
| Merchandise | 41,971 | | |
| Salt | 9,413 | | |
| Sand and gravel | 240,056 | | |
| Posts | 23 | | |
| Shingles | 316 | | |
| Sugar | 7,402 | | |
| Ties | 14,662 | | |
| Total | 1,367,779 | Total | 2,264,735 |

Total freight tonnage:

| | |
|---|---|
| 1903 | 3,632,514 |
| 1902 | 3,866,772 |
| Decrease | 234,258 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 2,088 | 1,419,430 |
| Departing | 2,074 | 1,444,657 |
| Built | 6 | 9,269 |

Total registered tonnage (vessels entering and departing):

| | |
|---|---|
| 1903 | 2,864,087 |
| 1902 | 3,235,761 |
| Decrease | 371,674 |

Draft of largest vessels using harbor, 20 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

### REPORT OF MR. WM. T. BLUNT, ASSISTANT ENGINEER.

TOLEDO, OHIO, *July 1, 1904.*

SIR: I have the honor to submit the following report upon Toledo Harbor, Ohio, for fiscal year ending June 30, 1904:

All depths mentioned are given at mean level of Lake Erie, 1860–1875, the lake surface being now about eight-tenths feet above that level.

### ICE JAMS AND FLOOD.

On January 23, 1904, the heavy ice in the river broke up after a protracted fall of rain throughout the Maumee Valley. It passed down with occasional stoppages at various places, and twice the water at Toledo reached a height of 10.8 feet above mean level—at noon January 23 and at midnight January 24. On the first run of ice much damage was done at Toledo. Four vessels moored to the wharves below the Pennsylvania bridge were carried away. Three of these drifted in on the flats below Ash street and were subsequently recovered without damage. One was carried down to lodgment against the west draw rest of the Wheeling and Lake Erie Railroad bridge, and with the second rush of ice it passed on down, carrying with it the stone pier and one iron truss of the bridge. It then passed safely through the Terminal bridge draw and lodged in the bay, southeast of the straight channel, 1 mile from mouth of river, and was released early in April. Several hundred feet of the Fassett Street bridge, in the portion crossing the flats, was torn down; a portion of the trestlework of the new Terminal bridge was carried away; the footbridge at Riverside Park was destroyed; the marine railway operated by James Scanes was entirely swept away, together with several vessels in process of repair, by one large field of unbroken ice pushed across the flats.

During the first rush of ice, and with the water nearly 11 feet above mean level, the weather turned very cold, shutting off the supply, but not the flow of water already in the stream. On the evening of the 24th, after a fall of 4 feet, the run slackened and the water rose again to nearly 11 feet above mean level, and at a height of 10 feet the entire field of jammed ice froze solid with temperature below zero. It is probable that at this time a gorge began to form in the bay, but with temperature at or below zero, the level gradually receded, until February 5, when it had reached its normal level, about 0.6 feet below mean level. With warm weather it at once rose again to 5 feet. These fluctuations continued even as high as 7 feet, giving continual anxiety until March 20, when the passage to the lake became clear. Thus for eight weeks, an unfavorable condition of weather might at any moment have precipitated a flood of a height never before known. The gorge which formed in the bay late in January held firmly throughout the entire period. Until some time in March there was no open water between Toledo and the islands, the entire west end of Lake Erie being covered with 18 to 24 inches of solid blue ice.

On February 23, 26, and 27, examinations were made of the ice conditions in bay and river, by use of a common ship auger attached to an extension rod. Broken ice in river and bay was frozen and packed entirely to the bottom, except in the channel, where it was 18 to 48 inches thick, with 2 to 10 feet of slush and loose cakes underneath. About 1 mile from mouth of river an immense gorge extended entirely across the bay and the ice was evidently packed solidly to the bottom. Even in the straight channel it was so solidly packed that the 1½-inch auger bored through 22 feet of it and was easily pulled out without cramping. The length of this pack in the channel was about 600 feet, located in section 6 of the inner division.

Many times the water rose above the wharf and into the storehouse, the level of the wharf being about 6 feet. Every precaution was taken to insure the safety of the floating plant, and enough men were always on watch to meet an emergency, while all hands were within telephone call. No serious damage occurred to United States property, although the winter repair work was greatly delayed.

### STRAIGHT CHANNEL THROUGH MAUMEE RIVER AND BAY.

*Description.*—The river and harbor act of March 3, 1899, authorized the construction of a straight channel through Maumee River and Bay 400 feet wide and 21 feet deep at a cost not to exceed $950,000. The portion of the channel from lake to Wheeling and Lake Erie Railroad bridge, about 8 miles in the bay and 1½ miles in the river, was included in a continuous contract with The Lydon & Drews Company, of Chicago, and work was begun upon it in May, 1900. The portion in Maumee River above Wheeling and Lake Erie Railroad bridge was assigned to the U. S. dredge *Maumee*, and work was begun in May, 1899.

At the close of the fiscal year the following areas had been dredged to upward of 21 feet: Outer division, 4 miles, lake to cribs 200 feet wide; middle division, 2 miles inward from cribs, 200 feet wide and 300 feet wide for about two-thirds of its length; inner division, 2 miles inward to mouth of river, 400 feet wide; Division H, 1½ miles, mouth of river to Wheeling and Lake Erie Railroad bridge, 400 feet wide. Areas remaining to be dredged under contract are: Outer division, widening from 200 to 400 feet; middle division, widening one-third from 200 to 400 feet, and two-thirds from 300 to 400 feet.

*Division E.*—Pennsylvania bridge to Ash street, 4,600 feet. Full width of 400 feet for length of 3,000 feet dredged in 1899, and an additional length of 1,400 feet, 120 feet wide, along the east bank. Average depth obtained, about 21.5 feet. The west half of this channel has scoured materially, so that depths now average greater than 22 feet. A fill has taken place on the east half, so that there is less than 21 feet depth for 100 feet width, though nearly everywhere greater than 20 feet.

*Division F.*—Ash street to Craig's shipyard, 2,800 feet. Full length and width was dredged in 1900–1901, leaving average depth 22.5 feet. A slight fill has taken place along the west edge, where depths are still greater than 20 feet, and over nearly the entire channel depths are a little more than in 1901.

*Division G.*—Craig's shipyard to Wheeling and Lake Erie Railroad bridge, 4,000 feet. Dredged in 1901 full width for 600 feet, by overlap from Division F. In 1903 a further length of 1,000 feet was dredged full width. Average depth after dredging was 22.5 feet in 1901 and 23.5 feet in 1903. Present depths average 23.5 feet over the whole.

*Division H.*—Wheeling and Lake Erie Railroad bridge to mouth of river, 10,600 feet. Natural depths were greater than 21 feet in parts of this channel, but for full width only through 1,600 feet of length. The channel was straightened and dredged to full width in 1902, leaving average depth of 23 feet over dredged portions. Present depths are probably a little more than after dredging.

*Division I* (*inner division*).—From mouth of river 11,200 feet through bay. Old width of 200 feet dredged in 1900, 100 feet widening on southerly side in 1902, 100 feet widening on northerly side in 1903, each leaving a depth of about 22.5 feet.

*Division J* (*middle division*).—From Division I 11,644 feet outward to main crib. Old width of 200 feet dredged in 1901, leaving average depth of 23 feet; 100 feet widening on northerly side now being done.

*Division K* (*outer division*).—From main crib to lake, 20,800 feet. Under 17-foot project this division was dredged to width of 300 feet. In 1901, 200 feet width was dredged under present contract, leaving average depth of about 23 feet.

Through Division I the clay bottom has been dredged to about 23 feet for full width, but owing to the lapse of time between the parts into which the work was necessarily divided some soft fill took place along the banks of the 200-foot cut. Upon continuing the cuts for widening much of this fill was thrown over into the preceding cut, thus forming a longitudinal ridge on each side of the axis. In a few places the depths on this ridge were as small 17 feet, but generally they were about 18 to 20 feet. The original cuts in clay having been carried to 23 and 24 feet, it is certain that these ridges will soon spread into the deep water on the sides, and it is believed that by the close of the contract this action will leave a clear depth of 21 feet over full width, as was originally intended. The recent soundings show this action to be rapidly taking place, the depths on cross section being much more nearly uniform now than last fall.

The results of the ice gorge of January–March, 1904, are quite serious, and are indicated for a distance of 2 miles beyond its location. For 1 mile extending into Division J there is only a very small area left with over 21 feet depth, and for the next mile in Division J the 21-foot channel has been greatly narrowed. Immediately outside the gorge the depth on axis is decreased to 17.5 feet, but beyond this there is generally over 20 feet, which will be increased by the passage of large vessels. It should be noted that following the ice jam in the spring of 1901 there was a decided fill in the same portion of channel. (See Annual Report, 1901, p. 3225.)

Through Division J, beyond the influence of the flood mentioned in preceding paragraph, the depths along the axis remain generally better than 22 feet, while the sides have been filled to about 19 and 20 feet. It does not appear that the widening of this division will produce so bad a ridge as was found in Division I.

Through Division K there has been some fill, quite evenly distributed. Within the lines of dredging in 1901 there is still nearly everywhere depth greater than 22 feet.

### STEAMER VISITOR AND SURVEY PARTY.

Ice began forming on November 25, and an unusually early and severe winter followed. *Visitor* continued in active service until December 7, and steam was kept up until the 18th. Owing to the dry-dock work upon the hull of tug *Spear*, the vessel was held in commission to assist in the work and to keep ice broken in slip until vessels should be placed for the winter. Active service was resumed April 12.

In addition to regular routine duties of inspection at various harbors, the following special duties were performed:

*Wreck, schooner General Franz Sigel.*—This vessel foundered off Stony Point, July 18, 1903. The wreck was located July 20, and its masts stood through the season.

This spring, all surface evidence having been destroyed, a buoy properly marked was placed alongside. It is expected the U. S. dredge *Maumee* will remove the obstruction upon its return from other harbors.

*Wreck, tug Champion.*—This tug was destroyed by fire September 15, while at anchor at Put in Bay. Several visits were made to locate and inspect.

*Inspection trip.*—The division engineer, with the district engineer and various assistant engineers, made an inspection trip to all harbors July 7 to 9.

*Survey, Huron Harbor, Ohio.*—In July, 1903, a complete survey of the harbor was made under the provisions of river and harbor act of 1902.

*Survey, Vermilion Harbor, Ohio.*—In August, 1903, a complete survey of this harbor was made under the provisions of the river and harbor act of 1902.

*Soundings.*—At Toledo, in the fall of 1903, soundings were taken over Division I, Division D, and part of Division C, to show results of dredging. In spring of 1904 complete soundings were taken over the entire length of channels.

At Port Clinton, Huron, and Vermilion, in spring of 1904, soundings were taken to determine condition of channels.

At Sandusky, in the fall of 1903, complete soundings were taken over entire channel to determine results of dredging. Again in spring of 1904, the channels were sounded for comparison. Accurate soundings were taken over the rock bottom to be removed under contract.

*Blockade at Conneaut.*—The *Visitor*, with assistant engineer, was engaged at Conneaut Harbor from November 4 to 11, clearing up a blockade caused by the filling in of the channel. Upon arrival, eleven large vessels were anchored outside the harbor, and there had been as many as twenty-five at one time. The harbor was practically closed to vessels drawing over 17.5 feet, and the continuous heavy weather greatly delayed work. Regulations were issued to control the use of the channel by all parties, and after much delay the blockade was raised.

A special report was made to you upon the subject, dated November 12, 1903.

*Coal consumption.*—During the season of 1903, the *Visitor* ran 5,583 miles, making 1,142 landings and anchorages, and burning 317½ tons of coal.

### STOREHOUSE AND FLOATING PLANT.

During the winter the fleet, consisting of steamer *Visitor*, dredge *Maumee*, tug *Thomas Spear*, new hull for tug, and six dump scows was laid up in the storage basin as usual, the derrick scow being at Lorain. Most of the skilled regular employees were retained through the winter for general repair work.

During the summer, a new hull named *Spear* was built by day labor at Lorain Harbor, to replace the old hull of tug *Thomas Spear*. This hull was towed to Toledo by *Visitor* November 13, 1903, and, as soon as possible, both hulls were placed in dry dock for transfer of shaft and other submerged work. They were in dock November 28 to December 12, and were then towed to slip. The work of transferring boiler and machinery, building deck house, and general fit out occupied the balance of the winter, and the tug was placed in commission April 12, making a trial trip to coal dock. From the first everything worked well, and while the new vessel will not equal the old in efficiency it is in many respects greatly superior. The entire fleet was overhauled during the winter, and machinery was put in order. Scows being in bad order throughout were only patched up where absolutely required. The entire deck of dredge was relaid and new coamings put under deck house.

*Visitor* was on Scanes' marine railway from September 1 to 8 for annual overhauling, scraping and painting of bottom, and examination of stern bearings, wheel, etc. The hull is still in excellent condition, except some plates under the boiler, which were badly corroded when the vessel was purchased in 1897.

Very respectfully,

Wm. T. Blunt,
*United States Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

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## P P 2.

## IMPROVEMENT OF PORT CLINTON HARBOR, OHIO.

The location and early history of this work are given upon pages 2647 and 2648, Report of Chief of Engineers, 1898.

The funds available at the beginning of the fiscal year 1904 amounted only to $75.91, and were not sufficient therefore to permit any work to be undertaken. An examination of the harbor was made on the 23d of June, 1904, and indicated that the depth secured by dredging in the previous year had been well maintained. There was a navigable depth of 10½ feet between the jetties and 12 feet outward to the lake. The riprap protection placed around the old jetties in previous years is generally in a good condition, but in some places it has settled down, and the total amount proposed has never been put in place. Additional work of this character is greatly needed to maintain the harbor. An appropriation of $7,500 is recommended for the purpose of maintenance only.

Attention is respectfully invited to the report of Asst. Engineer William T. Blunt, which is transmitted herewith.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $82.62 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 6.71 |
| July 1, 1904, balance unexpended | 75.91 |
| July 1, 1904, outstanding liabilities | 21.99 |
| July 1, 1904, balance available | 53.92 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 7,500.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | | | |
|---|---|---|---|
| July 10, 1872 | $8,000.00 | September 19, 1890 | $3,000.00 |
| July 10, 1872 (allotment) | 2,000.00 | July 13, 1892 | 10,000.00 |
| March 3, 1875 | 5,000.00 | August 18, 1894 | 6,000.00 |
| August 14, 1876 | 5,000.00 | June 3, 1896 | 6,000.00 |
| June 18, 1878 | 10,000.00 | March 3, 1899 | 6,000.00 |
| March 3, 1879 | 10,000.00 | June 13, 1902 | 5,000.00 |
| June 14, 1880 | 5,000.00 | | |
| March 3, 1881 | 5,000.00 | Total | 99,000.00 |
| August 2, 1882 | 6,000.00 | Expended to June 30, 1904 | 98,924.09 |
| August 5, 1886 | 2,000.00 | | |
| August 11, 1888 | 5,000.00 | Unexpended July 1, 1904 | 75.91 |

NOTE.—The river and harbor act of July 13, 1892, provided "that of the amount, $1,200 are to be paid to Charles Roose, of Oak Harbor, Ohio, in full satisfaction for the necessary portion of the sand beach adjoining the inner end of the west revetment of Port Clinton Harbor."

### COMMERCIAL STATISTICS.

The following statistics for the year 1903 relative to the commerce of the harbor of Port Clinton, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coal | 500 | Coal | 140 |
| Lath | 50 | Fruit | 401 |
| Lumber | 2,196 | | |
| Posts | 450 | | |
| Fish | 2,912 | | |
| Total | 6,108 | Total | 541 |

| Total freight tonnage: | |
|---|---|
| 1903 | 6,649 |
| 1902 | 11,613 |
| Decrease | 4,954 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 39 | 5,073 |
| Departing | 45 | 5,502 |

| Total registered tonnage: | |
|---|---|
| 1903 | 10,575 |
| 1902 | 23,545 |
| Decrease | 12,970 |

Draft of largest vessels using harbor, 14 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

### REPORT OF MR. WM. T. BLUNT, ASSISTANT ENGINEER.

Toledo, Ohio, *July 1, 1904.*

Sir: I have the honor to submit the following report upon Port Clinton Harbor, Ohio, for fiscal year ending June 30, 1904:

All depths mentioned are given at mean level of Lake Erie, 1860-1875, the surface being now about eight-tenths feet above that level.

No works for improvement of harbor have been conducted during the year. The last dredging done in the channels was in the fall of 1902 and spring of 1903.

Examination of channels on June 23, 1904, indicated that the harbor depths are holding practically as dredged in clay bottom, about 10.5 feet. Outside of piers, where channel 150 feet wide was made 12.5 feet deep, depths are now generally greater than 12.5 feet, except about 600 feet out from piers, where a least depth of 12 feet is found.

The riprap protection placed along the old timber piers and jetties in 1901 and previous years is generally in good condition, although in some places it has settled and spread so as to leave the piers exposed.

Very respectfully,

Wm. T. Blunt,
*United States Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

## P P 3.

## IMPROVEMENT OF SANDUSKY HARBOR, OHIO.

* * * * * * *

A contract was entered into with John J. Stang, of Lorain, Ohio, late in the season of 1902. His bid in the aggregate corresponded with the estimate, but was ill balanced, being too low for the rock and too high for some of the other material.

Work was in progress under this contract at the beginning of the fiscal year, and 60,296 cubic yards of soft material had been excavated. It was continued during the working season, and a total of 411,733 cubic yards were removed. This slightly exceeds the amount of soft material originally estimated, but owing to the deposit which continually takes place along the line of the channel, and which probably amounts to not less than 85,000 cubic yards per annum, it did not suffice to secure the full width desired throughout the cut.

* * * * * * *

For a detailed account of the work done, attention is respectfully invited to the report of Asst. Engineer William T. Blunt, which is transmitted herewith.

Now that a definite project has been adopted for a satisfactory improvement of this harbor, economy and advantage will undoubtedly result if funds are made available for the completion of the entire work.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $121,549.48 |
| Amount appropriated by sundry civil act approved April 28, 1904 | | 10,000.00 |
| | | 131,549.48 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $67,889.60 | |
| Allotment for new dredge | 40,000.00 | |
| | | 107,889.60 |
| July 1, 1904, balance unexpended | | 23,659.88 |
| July 1, 1904, outstanding liabilities | | 104.00 |
| July 1, 1904, balance available | | 23,555.88 |
| July 1, 1904, amount covered by uncompleted contracts | | 10,469.62 |
| Amount (estimated) required for completion of existing project | | 930,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $200,000.00 | |
| For maintenance of improvement | 18,000.00 | |
| | | 218,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | | | |
|---|---|---|---|
| June 11, 1844 | $15,000.00 | July 5, 1884 | $20,000.00 |
| August 30, 1852 | 15,000.00 | August 5, 1886 | 5,000.00 |
| June 28, 1864 (allotment) | 10,000.00 | August 11, 1888 | 40,000.00 |
| June 23, 1866 | 38,580.00 | September 19, 1890 | 45,000.00 |
| June 11, 1870 | 10,000.00 | July 13, 1892 | 41,712.00 |
| June 10, 1872 | 13,000.00 | August 18, 1894 | 30,000.00 |
| March 3, 1873 | 25,000.00 | June 3, 1896 | 40,000.00 |
| June 23, 1874 | 25,000.00 | March 3, 1899 | 80,000.00 |
| March 3, 1875 | 25,000.00 | June 13, 1902 | 125,000.00 |
| August 14, 1876 | 25,000.00 | April 28, 1904 (allotment) | 10,000.00 |
| June 18, 1878 | 20,000.00 | | |
| March 3, 1879 | 1,000.00 | Total | 691,792.00 |
| July 14, 1880 | 12,500.00 | Expended to June 30, 1904 | 668,132.12 |
| March 3, 1881 | 10,000.00 | | |
| August 2, 1882 | 10,000.00 | Unexpended July 1, 1904 | 23,659.88 |

LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for dredging at Sandusky Harbor, Ohio.*

Name of contractor: John J. Stang, Lorain, Ohio.
Date of contract: September 27, 1902.
Date of approval: October 18, 1902.
Date of commencement: November 14, 1902.
Date of completion: November 20, 1903.
Extended to include working season of 1904.

### COMMERCIAL STATISTICS.

The following statistics for the year 1903, relative to the commerce of the harbor of Sandusky, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coke | 2,122 | Coal | 810,049 |
| Fish | 1,481 | Merchandise | 18,424 |
| Grain | 5,092 | Sand | 41,220 |
| Iron ore | 130,612 | Stone | 130,233 |
| Iron, pig | 7,823 | | |
| Lumber, posts, lath, etc | 63,477 | | |
| Merchandise | 13,560 | | |
| Pulp wood | 1,275 | | |
| Sand | 222,904 | | |
| Salt | 4,300 | | |
| Stone | 20,493 | | |
| Wine | 675 | | |
| Total | 473,814 | Total | 999,926 |

Total freight tonnage:

| | |
|---|---|
| 1903 | 1,473,740 |
| 1902 | 1,357,316 |
| Increase | 116,424 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 3,937 | 787,903 |
| Departing | 3,929 | 801,997 |

Total registered tonnage:

| | |
|---|---|
| 1903 | 1,589,900 |
| 1902 | 1,757,679 |
| Decrease | 167,779 |

Draft of largest vessels using harbor, 20 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

### REPORT OF MR. WM. T. BLUNT, ASSISTANT ENGINEER.

TOLEDO, OHIO, *July 1, 1904.*

SIR: I have the honor to submit the following report upon Sandusky Harbor, Ohio, for the fiscal year ending June 30, 1904.

All depths mentioned are given at mean level of Lake Erie 1860–1875, the surface being now about eight-tenths foot above that level.

*Dredging.*—The only operations for improvement of harbor conducted during the year were under contract with John J. Stang, dated September 27, 1902, which provided for dredging the channels to a depth of 21 feet so far as funds would allow, including the removal of 5,403 cubic yards of rock. At the beginning of the year work was in progress by four dredges, and it was continued until the end of November, 1903, the contractor having obtained an extension of time. Owing to the fact that no move had been made toward the removal of rock, the work of earth dredging was not resumed in 1904 in order that the balance of funds should insure the completion of rock cut. At the close of year the rock cut has not been started.

The results obtained under this contract at the end of the season 1903 were:

*Outer channel.*—Width 200 feet throughout, average depth 21.8 feet, length of cut 5,200 feet on the new outer range straight from "deep hole" to lake. During the progress of the work a considerable fill took place in sections 6 and 7 by the working in of the shoal from the eastward, but nowhere on this shoal was the depth less than 19 feet, while generally it was greater than 20 feet.

*Straight channel.*—Width, 200 feet through inner half and 140 feet through the outer half of its length; average depth, 21.5 feet; length of cut, 9,600 feet. Owing to the limitation of funds, and consequent small excess of depth dredged, several places were found to have so much less than 21 feet that some redredging was done in sections 10 and 5. There were still many small areas with between 20 and 21 feet, but not such as to be serious obstructions.

*Dock channel.*—In this channel, from the "Short Line" freight wharf westward, the dredging was limited by rock bottom or bowlders. On the west portion, beyond the limits of solid-rock bottom, the dredge encountered rocks to such an extent as to generally preclude obtaining the depth of 21 feet.

In some places, on account of the narrowness of cut and softness of bottom, a large fill took place during and immediately after dredging. Along the main wharf front a width of 90 feet was made, with average depth of 21.4 feet in the east half and 18.8 feet in the west half, where bottom is solid rock and the least depth on rock was 17.5 feet.

On the extension of this channel up to the "Short Line" ore docks, a width of 60 feet was made and the bottom left was quite generally of rock or bowlders. Average depth, 19.5 feet.

Stang dredge *No. 1* was withdrawn from the work at the end of July; George H. Breymann & Bros. *No. 2*, October 17; George H. Breymann & Bros. *No. 1*, November 6, and Detroit Dredging Company *No. 2* remained till the close of work, November 24, having been away from July 1 to August 10.

The work of each dredge and the contract account were as follows:

| | Price. | Previously reported. | Fiscal year | Total. |
|---|---|---|---|---|
| | *Cents.* | *Cubic yards.* | *Cubic yards.* | *Cubic yards.* |
| Outer bar | 19 | 33,963 | 96,171 | 130,134 |
| Straight channel | 16 | 26,834 | 184,316 | 210,650 |
| Main dock channel | 19 | ............ | 55,443 | 55,443 |
| West dock channel | 19 | ............ | 15,506 | 15,506 |
| Total | ....... | 60,297 | 351,436 | 411,733 |

*Work of each dredge on contract.*

| | Outer bar. | Straight channel. | Main dock channel. | West dock channel. | Cubic yards per hour. |
|---|---|---|---|---|---|
| Stang No. 1 | ......... | 17,793 | ......... | ......... | 61 |
| G. H. B. No. 2 | 112,056 | 38,317 | ......... | ......... | 217 |
| G. H. B. No. 1 | ......... | 130,701 | ......... | ......... | 187 |
| D. D. Co., No. 2 | 18,078 | 23,839 | 55,443 | 15,506 | 128 |
| Total | 130,134 | 210,650 | 55,443 | 15,506 | ......... |

*Condition of channels.*—In May, 1904, soundings taken over the entire length of channels indicated conditions as follows:

*Outer channel.*—The shoal in sections 6 and 7 had materially decreased in area and the entire channel was in as good or better condition than before. Average depth was 21.7 feet, practically the same as after dredging, and only in a few small spots was depth less than 20 feet. In section 2 there seemed to be a tendency of the east bank to work into the channel.

*Straight channel.*—There were still many places where depth was less than 21 feet, and a few less than 20 feet, within the area dredged in 1903, with an average depth the same as then. While the shoal spots will probably not cause trouble, as the material will spread into deep water, it is quite certain that in the narrow portions vessels will ground on the banks and in a short time throw material into the cut.

*Dock channel.*—Along the main frontage there was indicated a fill of 0.2 feet over the entire length, rather evenly distributed. In a few places on the easterly half depths were less than 20 feet, but usually they were greater. On the extension to "Short Line" ore docks the average depth was the same as after dredging.

The usual table of comparative soundings is not justified on account of the unfinished condition of channels.

*Condition of permanent works.*—Investigation in June, 1904, indicated that the jetties are in good condition, only a very few stones having been slightly displaced by the elements. The submerged dam seems to have been in some places slightly disintegrated and spread, but not seriously. The submerged bank protection around straight channel front light seems intact and with quite a deposit of sand upon it.

In consequence of the opening up of the new outer channel to the lake the main light and the range light at Cedar Point were discontinued by the Light-House Establishment in spring of 1904, and the channel buoys were relocated to indicate the cut, the gas buoy being placed in 21 feet depth.

Very respectfully,

Wm. T. Blunt,
*United States Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

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## P P 4.

## IMPROVEMENT OF HURON HARBOR, OHIO.

A description of the early conditions of the harbor at the mouth of Huron River and of the projects for its improvement is given on pages 2653 and 2654, Report of Chief of Engineers, 1898.

An allotment of $500 was made from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors" for a survey of this harbor, and the work has been done and the report submitted and published as House of Representatives Document No. 122, Fifty-eighth Congress, second session.

The project submitted involves an expenditure in addition to the amounts already appropriated of $305,000. As the work to be done under the emergency appropriation is a part of that provided for in the new project the total amount can be diminished by $40,000. If this project receives the sanction of Congress the total amount could advantageously be expended before the 30th of June, 1906, but if it is deemed best not to appropriate or authorize the expenditure of the entire amount at this time, then an amount at least sufficient to provide for the construction of one pierhead and of the new east jetty should be provided, because it would be very disadvantageous, if not impracticable, to divide this piece of work into two separate contracts. The amount required would therefore be not less than $109,000.

For a detailed account of the work which has been done during the present year at this harbor, attention is respectfully invited to report of Assistant Engineer William T. Blunt, which is transmitted herewith.

* * * * * * *

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $15,046.53 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | | 40,000.00 |
| | | 55,046.53 |
| June 30, 1904, amount expended during fiscal year for maintenance of improvement | | 7,196.18 |
| July 1, 1904, balance unexpended | | 47,850.35 |
| July 1, 1904, outstanding liabilities | | 318.23 |
| July 1, 1904, balance available | | 47,532.12 |
| Amount (estimated) required for completion of existing project | | 77,500.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $265,000.00 | |
| For maintenance of improvement | 2,500.00 | |
| | | 267,500.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | | | |
|---|---|---|---|
| May 20, 1826 | $5,000.00 | March 3, 1881 | $3,000.00 |
| May 19, 1828 | 4,413.35 | August 2, 1882 | 2,500.00 |
| March 3, 1829 | 5,935.00 | July 5, 1884 | 7,500.00 |
| April 23, 1830 | 1,880.36 | August 5, 1886 | 3,000.00 |
| March 2, 1831 | 3,480.00 | August 11, 1888 | 6,000.00 |
| July 3, 1832 | 1,500.00 | September 19, 1890 | 16,000.00 |
| June 28, 1834 | 6,700.00 | July 13, 1892 | 15,000.00 |
| June 2, 1836 | 4,300.00 | August 18, 1894 | 10,000.00 |
| March 3, 1837 | 2,565.00 | June 3, 1896 | 8,000.00 |
| July 7, 1838 | 5,000.00 | March 3, 1899 | 25,000.00 |
| June 11, 1844 | 5,000.00 | June 13, 1902 | 40,000.00 |
| August 30, 1852 | 10,000.00 | April 28, 1904 (allotment) | 40,000.00 |
| June 23, 1866 | 39,000.00 | | |
| June 23, 1874 | 1,500.00 | Total | 277,273.71 |
| March 3, 1875 | 1,000.00 | Expended to June 30, 1904 | 229,423.36 |
| June 18, 1878 | 1,000.00 | | |
| June 14, 1880 | 3,000.00 | Unexpended July 1, 1904 | 47,850.35 |

COMMERCIAL STATISTICS.

The following statistics for the year 1903 relative to the commerce of the harbor of Huron, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Iron ore | 486,106 | Coal | 209,360 |
| Lumber | 800 | | |
| Posts | 23 | | |
| Stone | 5,096 | | |
| Total | 492,025 | Total | 209,360 |

Total freight tonnage:

| | |
|---|---|
| 1903 | 701,385 |
| 1902 | 795,382 |
| Decrease | 93,997 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 260 | 306,162 |
| Departing | 276 | 310,613 |

Total registered tonnage:

| | |
|---|---|
| 1903 | 616,775 |
| 1902 | 672,019 |
| Decrease | 55,244 |

Draft of largest vessels using harbor, 20 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

### REPORT OF MR. WM. T. BLUNT, ASSISTANT ENGINEER.

TOLEDO, OHIO, *July 1, 1904.*

SIR: I have the honor to submit the following report upon Huron Harbor, Ohio, for fiscal year ending June 30, 1904.

All depths mentioned are given at mean level of Lake Erie 1860–1875, the surface being now about eight-tenths foot above that level.

At the beginning of the fiscal year work by day labor was in progress upon the superstructure over cribs Nos. 3, 4, and 5, 122 feet 8 inches each, in the west pier, to replace the old structure. This work was completed September 1, 1903, including the planking over cribs Nos. 1 and 2, 120 feet each. Some repairs were made to the outer portion of the west pier by replacing old timbers and planks with new work. The balance of funds available did not justify further new work, and Mr. Simpson with a part of his crew was transferred to Lorain Harbor.

The following is a tabular statement of material received for the five cribs and of its disposition:

| | Hemlock. | Pine. | Oak. | Beech. | Iron. | Stone. |
|---|---|---|---|---|---|---|
| | *Feet B. M.* | *Feet B. M.* | *Feet B. M.* | *Feet B. M.* | *Pounds.* | *Tons.* |
| Purchased | 581,586 | 373,194 | 40,110 | 24,574 | 295,600 | 8,461 |
| Crib No. 1 | 111,366 | 71,025 | 15,252 | | 61,740 | 3,365 |
| Crib No. 2 | 111,862 | 70,916 | 15,528 | | 62,880 | |
| Crib No. 3 | 112,015 | 68,129 | 768 | 7,920 | 53,350 | 5,096 |
| Crib No. 4 | 111,986 | 68,184 | 768 | 7,971 | 54,150 | |
| Crib No. 5 | 115,312 | 64,772 | 768 | 7,986 | 53,420 | |
| Repairs | | | | | 5,560 | |
| Scow | 3,024 | 5,430 | | | | |
| West pier | | 2,962 | | | | |
| East pier | | 2,892 | 294 | | | |
| Miscellaneous | 978 | 2,652 | 562 | | | |
| Float | | 3,408 | | | | |
| Ways | 12,868 | | 3,876 | | | |
| Blocking and wastage | 1,765 | 44 | 948 | | | |
| On hand | 1,020 | 12,760 | 1,416 | 697 | 5,000 | |

During the winter Mr. Simpson was retained as watchman to look after the property, and owing to the serious floods of the winter and spring it was also necessary to employ some day labor to assist. No United States property of value was lost, although several vessels were torn from their moorings and carried to the piers or lake.

There now remains about 500 feet of west pier to be rebuilt in order to reach the shore. The outer end of the old pier reaching from shore to that recently constructed was found this spring to be in very bad condition, the stone filling having been nearly all washed out, leaving only the skeleton. In consequence of this serious condition an allotment of $40,000 from the emergency appropriation was made, and steps were at once taken to complete the rebuilding of this west pier to connect with the shore. Materials were contracted for late in June, 1904, and to properly store the 770,000 feet of timber and 110 tons of iron it was necessary to haul considerable filling into the low ground at the territory used for construction. This and other preparatory work is now being done.

In July, 1903, under the provisions of the river and harbor act of June, 1902, and by your direction, a survey was made of the harbor and its vicinity with a view to securing a channel depth of 20 feet. A topographical survey of the vicinity of the harbor was made by transit and stadia, based on an observed meridian. Soundings were taken through the river up to the Lake Shore and Michigan Southern Railway and out to 20 feet depth in the lake. The work was platted on scale 1:2000, and a project was made for improvement.

On September 11, 1903, a steel scow in tow of the tug *L. P. Smith* was capsized off Huron Harbor and its load of 475 tons of small stone was dumped in the lake. The captain's report placed the stone not less than a half mile nor more than a mile north by east from the light-house. Depths at these locations were 24 feet and 32 feet, respectively. Search was made to some extent, but on account of the uncertainty of location a search to a conclusion is not justified by the conditions.

On the night of September 17–18 the barge *James Dobbie* struck the end of the east pier, cutting away the face timbers from the end pocket on the river side from the top to several feet below water, eleven courses in all. The stone filling was washed out from a half pocket. Careful examination indicated that repairs could best be

## P P 6.

## IMPROVEMENT OF BLACK RIVER (LORAIN) HARBOR, OHIO.

A description of the location, conditions, and projects for improvement of this harbor is given on page 2658 of the Report of the Chief of Engineers, 1898.

The execution of the approved project, as far as the means available would allow, is now being carried out under a continuous contract with Patrick Keohane, of Fayetteville, N. Y., dated October 27, 1900, and modified by a supplementary agreement which provides for widening the jetty channel to 300 feet.

During the present fiscal year the contractor has built 1,192 running feet of concrete superstructure, which completes all but 188 feet of this kind of work. He has also deposited 17,903 tons of stone in the foundation of the west breakwater, and 21,989.7 tons of shale to form the core. While the work done by this firm is generally good, the rate of progress is very unsatisfactory. Seventy-two per cent of the time allowed for the completion of the work has already elapsed, and only 54 per cent has been completed. What remains to be done, however, is of a nature which could be carried forward rapidly, and it is possible for him to complete the work within the contract time.

* * * * * * *

After the new east jetty was completed the shore line showed a decided tendency to recede near the shore end of the structure, and this recession was so rapid that it seemed likely that the structure would be turned and a connection formed around the inner end of it between the lake and the river. A large amount of riprap stone was deposited, prolonging the jetty about 100 feet. Above water the stone was laid so as to generally conform to the jetty profile; but the recession continued until it reached the inner end of this extension. It was no doubt augmented by a condition which occurred in January, 1904, when, as the result of a severe freshet, an ice jam formed between the jetties, raising the water in the river 8 or 10 feet and causing it to flow across the flats into the lake around the inner end of the east jetty. Recently a brush and stone mattress, 20 feet wide and 600 feet long, has been built in place along the original shore line in water which is now from 1 to 4 feet in depth. This is stopping the recession of the shore and gradually re-forming the beach. The deposit is extending from the east toward the west. About 160,000 cubic yards of material dredged by the city of Lorain from the Black River had been dumped in the angle between the jetty and the beach as far inshore as the scows could be taken. It is hoped that this material will aid in re-forming the beach, but it does not appear to have done so as yet.

The same freshet which cut away the shore injured the channel
between the jetties by forming lumps and ridges upon which ther
less than the required depth of water. Tc e safe na
the U. S. dredge *Maumee* was sent to Lc the c
fiscal year was engaged in removing thes

The plan for the improvement of this harbor provides for the complete rebuilding of a section 365 feet in length of the west jetty, but it makes no provision for rebuilding or repairing the remaining 645 feet of this structure. The under-water portion of the jetty is in fairly good condition, the cribs having been built in recent years and sunk in dredged trenches upon proper foundations, but the superstructure, which is of timber, is rapidly decaying. Provision should be made in the way of maintenance for sheathing the under-water portion of the jetty, both on the lake and the channel side with hard-wood plank. The timber superstructure should be removed and replaced by a concrete top to conform to that already built. The estimated cost of this work, which is strictly maintenance, was $50,000, and the amount should be available as soon as possible.

This harbor is constantly growing in importance. The United States Steel Corporation and the Baltimore and Ohio Railroad Company are both increasing their docks and terminal facilities. The city of Lorain is expending $200,000 in widening and straightening the Black River within the shore line.

The receipts and shipments from this harbor, while they show some falling off from 1902, are still large, and the loss can be more than accounted for by the reduction in the receipts of ore which took place at this as at all of the Lake Erie harbors.

For a description of the work done during the present fiscal year, and for accurate tabular statements of the material and cost, attention is respectfully invited to the report of Assistant Engineer G. T. Nelles, which is transmitted herewith.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $309,506.69 |
| Amount appropriated by sundry civil act approved April 28, 1904 | | 100,000.00 |
| | | 409,506.69 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $65,084.20 | |
| For maintenance of improvement | 6,000.00 | |
| | | 71,084.20 |
| July 1, 1904, balance unexpended | | 338,422.49 |
| July 1, 1904, outstanding liabilities | | 14,366.67 |
| July 1, 1904, balance available | | 324,055.82 |
| July 1, 1904, amount covered by uncompleted contracts | | 223,520.35 |
| Amount (estimated) required for completion of existing project | | 256,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $86,000.00 | |
| For maintenance of improvement | 60,000.00 | |
| | | 146,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

### AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | | | |
|---|---|---|---|
| May 23, 1828 | $7,500.00 | March 3, 1881 | $7,000.00 |
| April 23, 1830 | 8,559.77 | August 2, 1882 | 7,000.00 |
| March 2, 1831 | 9,275.00 | July 5, 1884 | 10,000.00 |
| July 3, 1832 | 8,000.00 | August 5, 1886 | 10,000.00 |
| March 2, 1833 | 2,400.00 | August 11, 1888 | 10,000.00 |
| June 28, 1834 | 5,000.00 | September 19, 1890 | 12,000.00 |
| March 3, 1835 | 4,400.00 | July 13, 1892 | 20,000.00 |
| July 2, 1836 | 6,660.00 | August 18, 1894 | 10,000.00 |
| March 3, 1837 | 6,410.00 | June 3, 1896 | 30,000.00 |
| July 7, 1838 | 5,000.00 | March 3, 1899 | 50,000.00 |
| August 30, 1852 | 5,000.00 | June 6, 1900 | 125,000.00 |
| June 28, 1864 (allotment) | 20,000.00 | June 13, 1902 | 6,000.00 |
| June 23, 1866 | 10,000.00 | June 28, 1902 | 300,000.00 |
| June 10, 1872 | 20,000.00 | March 3, 1903 | 9,000.00 |
| March 3, 1873 | 20,000.00 | April 28, 1904 | 100,000.00 |
| June 23, 1874 | 20,000.00 | | |
| March 3, 1875 | 10,000.00 | Total | 882,204.77 |
| August 14, 1876 | 6,000.00 | Expended to June 30, 1904 | 543,782.28 |
| June 18, 1878 | 1,000.00 | | |
| June 14, 1880 | 1,000.00 | Unexpended July 1, 1904 | 338,422.49 |

### LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for constructing west breakwater, two pierheads, and removing and rebuilding parts of east and west piers.*

Name of contractor: Patrick Keohane, Fayetteville, N. Y.
Date of contract: October 27, 1900.
Date of approval: November 22, 1900.
Date of commencement: April 1, 1901.
Date of completion: Continuous contract.

### COMMERCIAL STATISTICS.

The following statistics for the year 1903 relative to the commerce of the harbor of Black River (Lorain), Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Iron ore | 1,103,468 | Coal and coke | 1,148,015 |
| Fish | 500 | Rails (steel) | 27,800 |
| Lumber, logs, etc | 37,080 | Billets (steel) | 2,294 |
| Sand and gravel | 23,000 | | |
| Stone | 26,325 | | |
| Total | 1,190,373 | Total | 1,178,109 |

| Total freight tonnage: | |
|---|---|
| 1903 | 2,368,482 |
| 1902 | 2,549,496 |
| Decrease | 181,014 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 571 | 693,111 |
| Departing | 578 | 784,093 |
| Built | 8 | 26,090 |

Total registered tonnage (vessels entering and departing):

| | |
|---|---|
| 1903 | 1,477,204 |
| 1902 | 1,873,913 |
| Decrease | 396,709 |

Draft of largest vessels using harbor, 20 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

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### REPORT OF MR. G. T. NELLES, ASSISTANT ENGINEER.

CLEVELAND, OHIO, *June 30, 1904*.

MAJOR: I have the honor to submit the following report of operations carried on under my local supervision at Lorain Harbor, Ohio, during the fiscal year ending June 30, 1904:

The improvement of this harbor is being made under project designated as plan "B," in report dated November 1, 1897, which provides for the construction of a small harbor of refuge in the lake at the mouth of the Black River, and the repair and reconstruction of the jetties beyond the shore line. The entrance to the proposed harbor will be between two pierheads about 500 feet apart and 1,850 feet beyond the end of the present west pier. A rubble mound breakwater 1,800 feet in length, running south from the west pierhead, will form the west side of the harbor, and a breakwater of somewhat similar construction 1,500 feet in length, running S. 75° E. from the east pierhead, will form the east side. These structures were designed not only to form a harbor but also to prevent the formation of bars at the mouth of the river, and to make the entrance easier and safer during stormy weather. The total cost of the improvements outlined was limited by the river and harbor act of March 3, 1899, to $650,000.

The construction of the west breakwater and the reconstruction of the piers is now being carried on under a continuous contract with Patrick Keohane, of Fayetteville, N. Y., dated October 27, 1900, and a supplementary agreement, which provides for the widening of the jettied channel to 300 feet, dated August 8, 1901. The total estimated cost of executing this contract, not including supervision and inspection, as revised January 14, 1904, is $454,577.40.

Plans for the construction of the east breakwater were approved by the Chief of Engineers, United States Army, May 21, 1904, and it is expected to place this work under contract as soon as the necessary formalities can be observed.

*Pier construction.*—The substructure, 1,762 feet long, and 738 linear feet of the concrete superstructure for the new east pier and the substructure for the reconstructed part of the west pier, 365 feet in length, had been completed at the beginning of the present fiscal year. During the year the concrete superstructure on the west pier, 356.47 feet in length, has been completed, also 836 linear feet of the east pier superstructure, making the total length of this superstructure 1,574 linear feet, and leaving 188 linear feet at the extreme outer end still to be done.

*Concrete.*—The following is a summary of our record of the concrete operations on these piers, the proportions being 1 cement, 2 sand, 3 gravel, and 4 screened broken stone:

| | Concrete blocks. | Concrete in mass. |
|---|---|---|
| | *Cubic yards.* | *Cubic yards.* |
| Cement (Sandusky Portland) | [a] 385 | [b] 900 |
| Beach sand | 770 | 1,800 |
| Broken stone | 1,540 | 3,320 |
| Beach gravel | 1,155 | 2,490 |
| Total volume of materials | 3,850 | 8,510 |
| Total volume of concrete | 2,575 | 5,569 |
| Ratio of concrete to materials . . . percentage | 66.9 | 65.5 |
| Barrels of cement per cubic yard | 1.01 | 1.10 |

[a] 2,600 barrels.

[b] 6,150 barrels.

The increase in the quantity of cement and other materials necessary to produce a cubic yard of concrete over previous reports is due to the fact that much of the earlier work was left in an incomplete condition and it has been necessary to surface and finish this work during the past season, and also because more cement has been used than before in plastering the forms and finishing up the new work.

*West breakwater construction.*—The progress made on this work has been very unsatisfactory, and not much better than during the preceding year. During the fall of 1903 about 8,500 tons of heavy riprap was placed in the foundation ridges, and during the present spring about an equal amount has been deposited, making a total of 17,902.9 tons for the year. Through an arrangement with the contractor engaged in dredging shale from the Black River in connection with the construction of the new docks at the United States Steel Company's plant, the contractor for our work has been able to secure a comparatively large quantity (21,989.7 tons) of this material for building up the core of the breakwater. In consequence of the manner in which this shale was obtained the core of the breakwater has been built up somewhat in advance of the other work, but as the supply of shale is now very limited it will only be a short time until the foundation ridges are built up ahead of the shale, and they will doubtless continue so until some other arrangement is made for core-filling material. The west foundation ridge is now up to proper grade for 990 linear feet, the east ridge for 600 linear feet, and the core filling has been approximately completed for 650 linear feet.

Under the terms of the contract with Patrick Keohane the work was all to have been completed within 30 working months from April 1, 1901, counting from May 1 to November 15 (6½ months) of each year as working time; this makes the termination of the contract September 1, 1905; 21½ working months as above determined have passed, during which time work to the value of $246,637.48, or 54 per cent of the whole contract, has been completed, leaving work to the value of $207,939.92, or 46 per cent of the whole contract, to be completed in 8½ working months, or 28 per cent of the whole time allowed.

During the winter months a very careful study was made of the form of cross section that had been adopted and was in use for the construction of rubble mound breakwaters at several of the harbors in this district. Although this study related particularly to the Cleveland breakwater, it was thought that some of the reasons advanced for modifying the Cleveland section were applicable to the breakwaters at other harbors, and in consequence it was recommended that the Lorain section be changed so that the slope of the pavement on the harbor side would be 1 on 1.3 instead of 4 on 3, and on the lake side 1 on 2 instead of 1 on 2½. The special reasons advanced for this recommendation, which was approved by the Chief of Engineers, United States Army, April 28, 1904, were that the pressure on the base would be better distributed; that both slopes of the breakwater would be open to the action of the sea, particularly until the east breakwater is constructed, and that the steep slope on the inner or harbor face would be difficult to build and likely to be unstable when built.

The character, quantities, and cost of the work to be done under this contract; the character, quantities, and cost of the work done during the year and the totals to date are as follows:

| Items. | Contract price per unit. | Total estimated cost. | | Cost for year. | | Total cost to date. | |
|---|---|---|---|---|---|---|---|
| | | Quantity. | Cost. | Quantity. | Cost. | Quantity. | Cost. |
| *West breakwater.* | | | | | | | |
| Paving....................tons.. | $1.87 | 27,000.00 | $50,490.00 | .......... | .......... | .......... | .......... |
| Small riprap..............do.... | .89 | 74,250.00 | 66,082.50 | .......... | .......... | .......... | .......... |
| Heavy riprap..............do.... | .90 | 45,000.00 | 40,500.00 | 17,903.00 | $16,112.70 | 20,392.00 | $18,352.80 |
| Core filling..............do.... | .70 | 70,000.00 | 49,000.00 | 21,989.70 | 15,392.79 | 29,448.00 | 20,613.60 |
| Total.................... | ..... | .......... | 206,072.50 | .......... | 31,505.49 | .......... | 38,966.40 |
| *East and west pier reconstruction and pierheads.* | | | | | | | |
| East pier removal...linear ft.. | 4.10 | 1,578.00 | 6,469.80 | .......... | .......... | 1,578.00 | 6,469.80 |
| West pier removal......do.... | 4.10 | 365.00 | 1,496.50 | .......... | .......... | 365.00 | 1,496.50 |
| Dredging........cubic yards.. | .19 | 125,162.00 | 23,780.78 | 5,249.00 | 997.31 | 125,162.00 | 23,780.78 |
| Hemlock..............M feet.. | 22.00 | 2,639,174.00 | 58,061.83 | 36,144.00 | 795.17 | 2,334,095.00 | 51,350.09 |
| Oak....................do... | 38.00 | 254,500.00 | 9,671.00 | 2,136.00 | 81.17 | 206,750.00 | 7,856.50 |
| Bolts, tie-rods, etc...pounds.. | .035 | 565,600.00 | 19,796.00 | 4,224.00 | 147.81 | 488,626.00 | 17,101.91 |
| Lag screws and spikes..do.... | .04 | 267,300.00 | 10,692.00 | 690.00 | 27.60 | 233,221.00 | 9,328.84 |
| Straps..................do.... | .05 | 2,390.00 | 119.50 | .......... | .......... | .......... | .......... |
| Concrete blocks...cubic feet.. | .37 | 81,600.00 | 30,192.00 | 37,157.00 | 13,748.09 | 62,279.00 | 23,043.23 |

IO.

WATE

NGMAN.,

GINEER.

THE

| Items. | Contract price per unit. | Total estimated cost. | | Cost for year. | | Total cost to date. | |
|---|---|---|---|---|---|---|---|
| | | Quantity. | Cost. | Quantity. | Cost. | Quantity. | Cost. |
| *East and west pier reconstruction and pierheads*—Cont'd. | | | | | | | |
| Concrete mass . . . cubic yards . . | $7.30 | 6,950.00 | $50,735.00 | 3,413.06 | $24,915.34 | 5,529.00 | $40,361.70 |
| Filling stone and pierhead foundation . . . . . . . . . . tons . . | .89 | 38,761.79 | 34,497.99 | 2,198.05 | 1,956.67 | 30,204.19 | 26,881.73 |
| Heavy riprap for pierhead foundation . . . . . . . . . . tons . . | .90 | 3,120.00 | 2,808.00 | . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . |
| Paving for well . . . . . . . . . do . . . . | 2.25 | 82.00 | 184.50 | . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . | . . . . . . . . . . |
| Total . . . . . . . . . . . . . . . . . . . . | | | 248,504.90 | | 42,669.19 | | 207,671.08 |
| Total cost . . . . . . . . . . . . . . . . | | | 454,577.40 | | 74,174.68 | | 246,637.48 |

*East breakwater construction.*—In July, 1903, application was made by the United States Steel Corporation for permission to dump shale excavated from the Black River in the vicinity of their works, at some point in the lake to be designated by the Secretary of War. The west breakwater work not being in shape to receive this shale it was decided to lay out the east breakwater and dump as much as possible of it along the line of this structure where it would be useful and effect a saving when the construction of the breakwater was finally undertaken. Forty-eight thousand seven hundred and twenty-five cubic yards have been deposited under this arrangement, and of this amount 43,600 cubic yards is so located that it will form part of the completed structure, and basing our estimate on the prices heretofore paid for this class of material under contract, the work done will result in a saving of fully $30,000 in the construction of the east breakwater.

On May 21 of the present year a project was approved by the Chief of Engineers for the completion of the east breakwater; the plan proposed is a slight modification of the present adopted method of breakwater construction; the shale already in place will be covered with a layer of quarry-run stone, composed of pieces ranging from 50 pounds to 5 tons; this is then covered with a 12-foot thickness of large blocks of stone weighing not less than 8 tons and averaging 10 tons each; these large stones are to be so deposited as to give the breakwater the proposed outline and reduce the voids as much as possible and keep the surface within 12 inches of the desired slopes. The cost of this structure, including supervision and inspection, is estimated to be $152,790; this amount exceeds the sum available for completing the present project, but with this style of construction the work can be so arranged as to be practically completed as it progresses and can be stopped whenever the funds provided are used up. A drawing showing the proposed cross section of this breakwater is transmitted herewith.

*Shore protection.*—In my last annual report it was stated that the connection between the east pier and the shore was unsatisfactory, and a plan was suggested to prevent the beach from cutting back so as to open a channel inside of the end of the pier. This plan was carried into effect by extending the pier 100 feet shoreward with a structure built up of large stone in approximately the shape of the existing pier. The work was done by hired labor and purchase of material in the open market at a total cost of $1,220.[illegible] [illegible] completed last fall, the beach [illegible] became necessary to devise [illegible] decided to construct a [illegible] long in from 1 to 4 feet of water [illegible] this work, which was estimated [illegible] has since been carried out at [illegible] figured on in original estimate [illegible] along the whole beach line [illegible] line is building up from the [illegible] completely covered up [illegible] cubic yards of material [illegible] the city of Lorain has been [illegible] in hopes that the material [illegible] reason this result has not been [illegible] run along parallel to the [illegible] of our work.

*Repair old piers.*—The timber superstructure of the inner 400 feet and outer 245 feet of the old west pier not included in the present contract is deteriorating rapidly and should be repaired without delay, therefore I respectfully renew the recommendation made in my last annual report, to repair the remainder of this pier so as to make it uniform with the 365 feet which has already been reconstructed with concrete superstructure under the existing contracts. The estimated cost of rebuilding the superstructure with concrete and sheathing both sides below water with 3-inch plank is as follows:

| | |
|---|---|
| Tearing out old cribs and preparing same for superstructure, 645 linear feet, at $10 per linear foot | $6,450.00 |
| Mass concrete for superstructure, 2,200 cubic yards, at $9 per cubic yard | 19,800.00 |
| Concrete blocks for superstructure, 900 cubic yards, at $12 per cubic yard | 10,800.00 |
| Sheathing with 3-inch beech plank, 62,800 feet B. M., at $130 per M feet B. M. | 8,174.40 |
| Supervision and contingencies, 10 per cent | 4,522.44 |
| Total | 49,746.84 |

*Dredging.*—The freshet in the Black River January 21–22 caused more or less deposit throughout the jettied channel and left several lumps and obstructions on which the depth was less than 18 feet. It was therefore decided to bring the U. S. dredge *Maumee* to Lorain as soon as she completed the work at Fairport and have her dredge out all of the channel between the jetties, so as to provide a depth of 21 feet. The dredge reached Lorain on the 11th and has since excavated 11,532 cubic yards at a cost of $1,405.53 and has completed about 60 per cent of the work necessary for the contemplated improvement.

*Black River.*—Extensive improvements are being made in the Black River by the city of Lorain and private interests. The city is widening and straightening the channel at an estimated cost of $200,000; the steel corporation is lengthening and extending the docks at their plant and enlarging their turning basin, and the Baltimore and Ohio Railroad has under contruction extensive docks for loading coal on vessels. A very disastrous flood visited this section in January, 1904, doing great damage to shipping and property in the river bottom; the cause and effect of the flood are fully discussed in a special report covering the three rivers under my local supervision, which is transmitted herewith.

Observations have been continued through the year to determine the daily flow and quantity of sediment carried to the lake by the Black River. These observations also are made the subject of a special report.

The work at Lorain has been carried on under the local supervision of Inspector Alexander J. Savord.

Very respectfully,

G. T. Nelles,
*United States Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

## P P 7.

## IMPROVEMENT OF CLEVELAND HARBOR, OHIO.

For a history of the early conditions and projects of improvement, see pages 2661 and 2662, Report of the Chief of Engineers, 1898, and pages 530 and 531, Report of the Chief of Engineers, 1899.

The work of renewing the superstructure of the west breakwater has been completed, and there remains to be done under this contract only a small amount of work connected with sheathing the cribs on the exposed side. The repairs to the east breakwater are well advanced and the work is being done by hired labor. All of the work which it was proposed to do under this continuous contract can be completed with the funds which have already been appropriated. The total amount appropriated is $222,800 less than the amount authorized to be expended, and this saving which has been effected should be given due credit in determining the cost of the Cleveland Harbor improvement. There is plenty of work in the way of maintenance to which this amount could be applied if authorized, and there are two things of pressing necessity in the way of maintenance to which attention is specially invited.

A number of years ago, before the work of rebuilding the superstructure on the west breakwater was begun, an opening 200 feet wide was made in the shore arm of this breakwater to permit the circulation of water in the harbor. The shoreward end of this opening was 700 feet distant from the harbor line, measured along the axis of the shore arm. This left a corresponding length of breakwater for the repair and maintenance of which no provision whatever was made in the estimate. The superstructure of this portion of the work is now in a ruinous condition, as is clearly shown in the photographs which accompany this report. It can not last much longer, and if breached or destroyed it will leave an opening, together with that which already exists, of 900 feet between the end of the shore arm and the beach, and through this opening such a quantity of material will be washed by westerly storms as to utterly ruin and destroy the entire west basin. This 700 feet of structure ought to be rebuilt and strengthened and provided with a new superstructure in all respects similar to the rest of the breakwater. The cost of this work is estimated at $92,070, and it should be provided for without delay.

The west breakwater now consists of a substructure of timber cribs, each about 50 feet long, sunk end to end on the natural bottom of the lake, and a superstructure made up of large blocks of concrete of a width equal to that of the breakwater and a length of from 20 to 30 feet each. The concrete rests on the top of the timber cribs, and it must be admitted that these structures furnish a poor support for any kind of masonry. In the time of storms they yield to the shock of the waves, and cause the concrete blocks to rub and wear against each other. Hitherto the alignment has been well preserved, but if any one of these blocks should start to move it would be very apt to work outward or inward until it slipped off its foundation, and thus start an injury in the form of a breach which might extend indefinitely, and which would be extremely difficult to repair.

The breakwater ought to be strengthened by sheathing the cribs below water on the harbor side with hard-wood plank bolted vertically, and by reenforcing it heavily by large riprap on the lake side, so as to break up the force of the waves. The cost of the work will be $88,689.92. The aggregate of these two amounts is $180,759.92, which is less than the amount saved from the original estimate, and is urgently needed for maintaining the harbor.

* * * * * * *

In January, 1902, and again in January, 1904, the area within the breakwater was carefully sounded through the ice so that the position of the soundings could be truly located, and the work was done in both cases by the same survey party. These two surveys afforded an excellent means of making a comparison whereby the amount of deposit in the harbor can be correctly arrived at, and nothing so suitable has ever been made before. The result of this comparison indicates that there has been a deposit within this area in a period of two years of not less than 500,000 cubic yards of material. If this same rate of deposit occurred in the two years prior to 1902, then the net result of all the dredging that has been done under this project has been an increase in the amount of silt in the harbor of nearly one quarter of a million cubic yards. In other words, the work has not been sufficient even to maintain the conditions that existed at the outset. The deposit has gained on the dredging. This shows how impossible it is to furnish a reliable estimate of the cost of doing a piece of dredging work in silt-bearing water where the operation is to be extended over a number of years. Information is at hand to show where this deposit came from.

For the past two years the Cuyahoga River has been under careful observation and measurement in order to determine its regimen. Under the direction of this office a station was selected above the influence of the backwater from the lake and a sufficient number of discharge observations were made to permit of the construction of a discharge curve. A gauge was established, which has been read twice a day for two years, and at the same time daily samples of water have been taken at a point near the outer end of the jetties. These samples have been filtered and the solid residue dried and weighed, and this, with the known daily volume of discharge, has furnished a means of computing the amount of sediment brought down by the river. The result shows that from the 1st day of May, 1902, to the 1st day of May, 1904, 940,000 cubic yards of silt passed out between the jetties at the mouth of the Cuyahoga River. Since the measurable deposit in the harbor was only 500,000 cubic yards in two years it is evident that some part of the silt has gone out into the lake, but the quantity is more than sufficient to account for all of the deposit found. This information is definite and is valuable accordingly, and it shows, as a whole, that no advance has been made in deepening the harbor to 25 feet. Of course the material has not come directly back to the place from which it was removed. All of the dredging has been done between the jetties, or in the eastern basin, and here the average depth is greater than it was. No dredging has been done in the western basin, and here the average depth is much less.

To maintain the depth in this harbor we must be prepared for an average annual dredging of not less than 250,000 cubic yards. The suction dredge which has recently been authorized for this district will no doubt be very valuable, economical, and efficient for this work. There is now available from the river and harbor appropriation of 1902 about $45,000, which can be applied to dredging by the operation of this machine when it arrives in the district. There should be provided in the way of maintenance an amount not less than $20,000 a year for the dredging, and in order to make a reasonable advance upon the dredging project not less than $100,000 should be appropriated for this purpose.

* * * * * * *

At the end of the present fiscal year work at the new entrance was 17 per cent completed, and on the breakwater extension it was 13 per cent completed. All of this new work is a rubble mound structure, and in the interest of economy a provision was made permitting the use of a certain amount of sand for the formation of the core of the structure at depths greater than 20 feet below mean lake level. This style of construction was necessarily experimental, and on trial in a short length of breakwater it was found that a considerable portion, amounting in some cases to as much as 20 per cent, of the sand escaped through the openings in the stone ridges that confined it. To prevent this the cross section was modified, and the inner slopes of the rubblestone ridges which defined the base of the structure are now covered with a very thick layer of coarse core filling to prevent the escape of the sand. Supplementary agreements are being entered into to give effect to this change. At the same time a slight modification in the profile of the structure was authorized, whereby the exterior slope was made somewhat steeper and the interior slope, or slope toward the harbor side, was made a little flatter. In the original design a part of this harbor slope was too steep for certain stability.

One of the great difficulties attending the work of improving the harbor at Cleveland is due to the fact that the United States is entirely without wharves or convenient landing facilities. There is no place to store material except on the jetties or breakwater, and there are no wharves which the United States controls for the use and occupancy of the floating plant. The United States owns in Cleveland a tract of ground used for the marine hospital. This ground borders on the lake and is situated just east of Erie street. When the proposed improvements are completed this frontage will be very nearly in the center of the harbor and will be an extremely valuable piece of property. The city is already filling in and constructing wharves out to the harbor line just west of Erie street, and no doubt as soon as the new breakwater affords sufficient protection other wharves will be built, either by the city or private companies—probably by the former—eastward to the extreme end of the proposed harbor, and adequate trackage will be arranged on the made land to accommodate all railroads which come to the city, and to afford them convenient access to the wharves.

The frontage on the lake at the marine hospital site is about 700 feet. If the United States should improve it by the construction of wharves and slips terminating on the harbor line, and by filling in to the shore, it would afford an admirable location for an engineer depot, with suitable wharf room for the floating plant pertaining to the district, which now has a value of nearly one quarter of a million dollars, for which there is no suitable mooring place. There would also be sufficient wharf front for a light-house depot, and for use of the Revenue-Cutter and the Custom-House services generally, and for the use of the Navy Department. The excavation in the slips, and advance of the harbor line, and elsewhere in the inclosed area in the old harbor, would afford more than sufficient material to make the fill, and the cost of the improvement would be small in comparison with its great value. There would be 15 or 20 acres of made land south of the slips, which would be worth not less than $40,000 an acre, which would not be needed, and which might be sold at a price which would more than repay the cost of this improvement.

I would suggest the construction of two slips 150 feet wide and 700 feet deep, with wharves upon each side of them. This would afford 2,800 linear feet of wharf front, not counting the inner ends of the slips. It is not necessary that this entire improvement should be made at once. Without submitting it as an estimate of cost, I should say that the probable total outlay, supposing all the work to be constructed in a permanent and durable way, would be $500,000, and an appropriation of a portion of this sum could be expended now to the great advantage of the public service.

For a detailed description of the work done at this harbor during the past year, and for a statement of cost and quantities of material used, attention is respectfully invited to the report of Asst. Engineer G. T. Nelles, which is transmitted herewith.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $906,168.55 |
| Amount appropriated by sundry civil act approved April 28, 1904 | | 485,200.00 |
| Returned from allotment for repair of levee at Zanesville, Ohio, sundry civil act July 1, 1898 | | 56.52 |
| | | 1,391,425.07 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $33,212.47 | |
| For maintenance of improvement | 325,033.72 | |
| Allotment for new dredge | 40,000.00 | |
| | | 398,246.19 |
| July 1, 1904, balance unexpended | | 993,178.88 |
| July 1, 1904, outstanding liabilities | | 65,501.10 |
| July 1, 1904, balance available | | 927,677.78 |
| July 1, 1904, amount covered by uncompleted contracts | | 2,287,817.30 |
| Amount (estimated) required for completion of existing project | | 3,800,156.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $600,000.00 | |
| For maintenance of improvement | 230,000.00 | |
| | | 830,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | |
|---|---|
| March 3, 1825 | $5,000.00 |
| March 2, 1827 | 10,000.00 |
| March 29, 1829 | 12,179.00 |
| April 23, 1830 | 1,786.56 |
| March 2, 1831 | 3,670.00 |
| July 3, 1832 | 6,600.00 |
| June 28, 1834 | 13,315.00 |
| July 2, 1836 | 15,006.59 |
| March 3, 1837 | 10,000.00 |
| July 7, 1838 | 51,836.00 |
| June 11, 1844 | 25,000.00 |
| August 30, 1852 | 30,000.00 |
| March 3, 1853 | 145.69 |
| June 28, 1864 (allotment) | 20,000.00 |
| June 23, 1866 | 59,806.00 |
| June 25, 1868 (allotment) | 17,000.00 |
| April 10, 1869 (allotment) | 13,380.00 |
| July 11, 1870 | 20,000.00 |
| March 3, 1871 (allotment for repairs) | 636.77 |
| March 3, 1873 | 1,000.00 |
| June 24, 1874 | 30,500.00 |
| Total previous to adoption of project for harbor of refuge | 346,881.61 |
| March 3, 1875 | 50,000.00 |
| August 14, 1876 (repair of pier) | 8,000.00 |
| August 14, 1876 | 50,000.00 |
| June 18, 1878 | 100,000.00 |
| March 3, 1879 | 100,000.00 |
| June 14, 1880 | 125,000.00 |
| March 3, 1881 | 200,000.00 |
| August 2, 1882 | 175,000.00 |
| July 3, 1884 | $100,000.00 |
| August 5, 1886 | 93,750.00 |
| August 11, 1888 | 100,000.00 |
| September 19, 1890 | 75,000.00 |
| July 13, 1892 | 100,000.00 |
| August 18, 1894 | 50,000.00 |
| June 3, 1896 | 80,000.00 |
| June 4, 1897 | 350,000.00 |
| July 1, 1898 | 294,000.00 |
| March 3, 1899 | 75,000.00 |
| Do | 100,000.00 |
| June 6, 1902 | 175,000.00 |
| June 13, 1902 | 625,000.00 |
| June 28, 1902 | 107,000.00 |
| March 3, 1903 | 227,500.00 |
| September 6, 1902 (received on account of damages to west jetty) | 77.44 |
| March 6, 1903 (received on account of damages to west jetty) | 200.00 |
| April 28, 1904 | 25,200.00 |
| Do | 460,000.00 |
| February 4, 1903 (unexpended balance of allotment of $6,000 for repair of levee of Muskingum River, for "Improving Harbor at Cleveland, Ohio") | 56.52 |
| Total | 4,192,565.57 |
| Expended to June 30, 1904 | 3,199,486.69 |
| Unexpended July 1, 1904 | 993,178.88 |

### LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for repair of west breakwater.*

Name of contractor: Hunkin Brothers, Cleveland, Ohio.
Date of contract: April 28, 1897.
Date of approval: May 19, 1897.
Date of commencement: August 3, 1897.
Date of completion: Continuous contract.

*Contract for improvement and enlargement of Cleveland Harbor, Ohio, eastern division.*

Name of contractor: Hughes Bros. & Bangs, Syracuse, N. Y.
Date of contract: November 20, 1902.
Date of approval: December 30, 1902.
Date of commencement: April 1, 1903.
Date of completion: Continuous contract.

*Contract for improvement and enlargement of Cleveland Harbor, Ohio, western division.*

Name of contractor: Hughes Bros. & Bangs, Syracuse, N. Y.
Date of contract: November 20, 1902.
Date of approval: December 30, 1902.
Date of commencement: April 1, 1903.
Date of completion: Continuous contract.

*Contract for improvement of main entrance to Cleveland Harbor, Ohio.*

Name of contractor: The L. P. & J. A. Smith Company, Cleveland, Ohio.
Date of contract: November 19, 1902.
Date of approval: January 9, 1903.
Date of commencement: April 1, 1903.
Date of completion: Continuous contract.

### COMMERCIAL STATISTICS.

The following statistics for the year 1903 relative to the commerce of the harbor of Cleveland, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Coal and coke | 560 | Coal | 3,082,855 |
| Fish | 5,500 | Iron ore | 2,634 |
| Grain and produce | 53,675 | Iron, pig | 135 |
| Iron ore | 4,916,224 | Iron and structural steel | 6,100 |
| Iron, pig | 7,773 | Lumber, logs, etc | 5,600 |
| Iron and structural steel | 1,400 | Grain and produce | 12,015 |
| Lumber, logs, etc | 628,650 | Stone | 905 |
| Salt | 1,894 | Oil | 25,180 |
| Stone | 374,268 | Miscellaneous | 802,224 |
| Oil | 380 | | |
| Miscellaneous | 123,461 | | |
| Total | 6,112,785 | Total | 3,937,648 |

Total freight tonnage:

| | |
|---|---|
| 1903 | 10,050,433 |
| 1902 | 10,151,006 |
| Decrease | 100,573 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 4,629 | 4,522,894 |
| Departing | 4,639 | 4,603,206 |
| Built | 16 | 63,978 |

Total registered tonnage (vessels entering and departing):

| | |
|---|---|
| 1903 | 9,126,100 |
| 1902 | 9,527,691 |
| Decrease | 401,591 |

Draft of largest vessels using harbor, 20 feet.

Largest vessels do not load to full depth.

New vessel lines established as follows: The Volunteer Transit Company, the Cowle Transit Company, the Gilchrist Transportation Company, the French Transportation Company, the Mack Steamship Company, the Marquette and Bessemer Dock and Navigation Company, the Wisconsin Transit Company.

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### REPORT OF MR. G. T. NELLES, ASSISTANT ENGINEER.

CLEVELAND, OHIO, *June 30, 1904.*

MAJOR: I have the honor to submit the following report of operations carried on under my local supervision at Cleveland Harbor, Ohio, during the fiscal year ending June 30, 1904:

*West breakwater repairs.*—This work is being done under the river and harbor act of June 3, 1896, which provided $1,354,000 for the completion of the east breakwater in accordance with the then existing project, for the repair of the west breakwater, for sheathing the lake face of the old portion of the east breakwater, for rebuilding the west pier at the mouth of the river and 322 feet of the east pier, and for widening the channel. Under this authority the west pier (1,440 linear feet) has been rebuilt as far as the necessary right of way was provided; 322 feet at the outer end of the east pier has been reconstructed, and the east breakwater has been extended 2,735 linear feet, which is 270 linear feet less than originally contemplated; the jetted channel has been widened to 325 feet; the old east breakwater has been repaired and much of it sheathed on both sides above and below water; the superstructure of the west breakwater for 5,334.6 linear feet has been reconstructed with concrete, and the lake face nearly all sheathed with oak. The total expended to date has been nearly $1,100,000.

The west breakwater repairs are being executed at a total estimated cost of $445,376.13, by Hunkin Brothers, of Cleveland, Ohio, under a continuous contract dated April 28, 1897, and three supplementary agreements, dated, respectively, August 25, 1897, May 31, 1898, and February 7, 1899. The progress made during the year under this contract has not been very satisfactory, owing largely to difficulty experienced in building up old cribs Nos. 99 and 100, which were badly injured below water by the wreck of a whaleback barge in November, 1898. It was necessary in order to satisfactorily repair these cribs to tear them down to about 9 feet below mean lake level and sink auxiliary cribs on the foundation thus prepared. As most of this work had to be done by divers, it was necessarily slow and exceedingly expensive. The under-water work was all completed and the auxiliary cribs set in place last fall, too late to receive the concrete superstructure. The concrete work was resumed on May 6, and was completed, except some minor repairs, on June 11, so that at this writing all that remains to complete this contract is about 750 linear feet of sheathing on the lake side, which will probably be finished during the present season.

The work completed during and to the end of the present year is as follows:

| Designation. | | Completed during fiscal year 1904. | Total completed to June 30, 1904. |
|---|---|---|---|
| Old superstructure removed | linear feet.. | 221.0 | 5,328 |
| Concrete base completed | do.... | 501.3 | 5,328 |
| Concrete parapet completed | do.... | 612.9 | 5,339 |
| Oak fender completed on harbor side | do.... | 842.0 | 5,313 |
| Oak sheathing completed on lake side (to old crib No. 88) | do.... | 150.4 | 4,387 |
| Concrete blocks made | number.. | 17.0 | 1,604 |
| Concrete blocks set | do.... | 33.0 | 1,604 |

The character, estimated total quantities, and cost of the work required under this contract; the character, quantities, and cost of the work done during the year, and the totals to date are as follows:

| Items. | Contract price per unit. | Total estimated cost. | | Cost for year. | | Total cost to date. | |
|---|---|---|---|---|---|---|---|
| | | Quantity. | Cost. | Quantity. | Cost. | Quantity. | Cost. |
| White oak sheathing..M feet.. | $139.00 | 368,076 | $51,162.56 | 9,628.60 | $1,338.37 | 266,125.0 | $36,991.38 |
| White oak waling ......do.... | 139.00 | | | 624.00 | 86.74 | 46,300.0 | 6,435.70 |
| Hemlock timber........do.... | 17.25 | 261,900 | 4,517.78 | 20,440.00 | 352.59 | 267,046.0 | 4,606.54 |
| Old timber..............do.... | 9.85 | 595,000 | 5,860.75 | 34,474.00 | 339.57 | 507,049.5 | 4,994.44 |
| Concrete blocks...cubic feet.. | .49½ | 250,310 | 123,486.27 | 11,585.32 | 5,715.42 | 245,273.94 | 121,001.81 |
| Concrete steps ..........do.... | .49½ | 450 | 222.00 | 155.00 | 76.47 | 155.0 | 76.47 |
| Concrete mass...cubic yards.. | 5.32 | 40,700 | 216,524.00 | 3,082.79 | 16,400.44 | 40,646.2 | 216,237.78 |
| Lag screws..........pounds.. | .03 | 88,230 | 2,646.90 | 2,009.60 | 60.29 | 60,574.0 | 1,817.22 |
| Screw bolts ............do.... | .03 | 12,300 | 369.00 | 188.00 | 5.64 | 11,673.0 | 350.19 |
| Iron rods...............do.... | .13 | 64,104 | 8,333.52 | 2,002.00 | 260.26 | 57,818.0 | 7,516.34 |
| Mooring rings...........do.... | .10 | 3,710 | 371.00 | 385.00 | 38.50 | 4,004.0 | 400.40 |
| Wire nails...............do.... | .05 | 7,000 | 350.00 | 700.00 | 35.00 | 10,618.0 | 530.90 |
| Total | | | 413,843.78 | | 21,709.29 | | 400,959.17 |
| *Supplementary agreement, August 25, 1897.* | | | | | | | |
| White oak fenders ....M feet.. | 45.00 | 110,240 | 4,960.80 | 17,057.00 | 767.56 | 101,516.0 | 4,568.22 |
| Iron set in masonry..pounds.. | .06 | 54,823 | 3,289.38 | 4,760.00 | 285.60 | 69,025.0 | 4,141.50 |
| Total | | | 8,250.18 | | 1,053.16 | | 8,709.72 |
| *Supplementary agreement, February 7, 1899.* | | | | | | | |
| Oak timber ...........M feet.. | 45.00 | | | 405.00 | 18.23 | 7,793.0 | 350.69 |
| Diver and helpers .....hours.. | 3.24 | | | 7.00 | 22.68 | 393.0 | 1,273.32 |
| New timber, outside walls, M feet | 50.00 | | | 2,520.00 | 126.00 | 6,300.0 | 315.00 |
| Riprap between cribs.cu. yds.. | 3.00 | | | 2.00 | 6.00 | 152.0 | 456.00 |
| Hemlock new cribs...M feet.. | 40.00 | | | 57,480.00 | 2,299.20 | 96,187.0 | 3,847.18 |
| Filling stone cribs ...cu. yds.. | 2.40 | | 23,282.17 | 680.00 | 1,632.00 | 1,463.9 | 3,513.36 |
| Lag screws..........pounds.. | .03 | | | 11,230.00 | 336.90 | 16,947.0 | 508.11 |
| Screw bolts ............do.... | .03 | | | | | | |
| Iron rods...............do.... | .13 | | | | | | |
| Wire nails...............do.... | .05 | | | | | | |
| Labor, repairing break, raising and reenforcing old cribs.... | | | | | 7,767.42 | | 11,165.28 |
| Dredging along harbor face of break | | | | | | | 1,569.00 |
| White pine timber[a] ..M feet.. | 22.00 | (20 p. ct added) | | | | 9,312.0 | 245.83 |
| Wire nails[a] ..........pounds.. | .05 | ....do | | | | 630.0 | 37.80 |
| Total | | | 23,282.17 | | 12,208.43 | | 23,282.17 |
| Total cost | | | 445,376.13 | | 37,970.88 | | 432,951.06 |

[a] Repairing old superstructure.

In addition to the work done under contract, 1,565.7 tons of large riprap stone has been purchased in the open market and deposited along the lake face of old cribs Nos. 96 to 99. There was an undue settlement of old cribs Nos. 96, 97, and 98 after the base of the concrete superstructure had been built. Crib No. 96, on which the cableway tower and machinery sat, settled down about 4 inches and out toward the lake about 6 inches; the displacement of the other two cribs decreased to the eastward, and was practically nothing at crib No. 99. The superstructure on these cribs was repaired and built up to proper shape and grade.

*Dredging.*—The dredging of the main entrance channel between the Lake Shore Railroad bridge and the main entrance to a depth of 25 feet was in progress at the beginning of the fiscal year under a contract with the L. P. & J. A. Smith Company, dated August 27, 1902. This work was completed in October, at which time a total of 175,699 cubic yards had been dredged at a cost of $32,504.32.

The following is a statement of the quantity and cost of the work done under this contract:

| | Work done during fiscal year. | | Total work done under contract. | |
|---|---|---|---|---|
| | Quantity. | Cost. | Quantity. | Cost. |
| Dredging, cubic yards | 92,707 | $17,150.80 | 175,699 | $32,504.32 |
| Logging, hours | | | 4¼ | 130.09 |
| Total | | 17,150.80 | | 32,634.41 |

The soundings taken through the ice last winter show a general reduction in the depth of the jettied channel to about 21 feet, notwithstanding the fact that the whole area had been deepened to fully 25 feet during the preceding year, indicating clearly the difficulty of maintaining a depth of 25 feet between the jetties until the adjoining areas are dredged to the same depth.

The freshet of January caused a slight scour in the channel between the main entrance and the Lake Shore Railroad bridge and a marked shoaling in the east and west basins in the immediate vicinity of the channel, the depth being reduced to about 16 feet. In order to avoid delaying vessels making use of the docks in the east basin it was decided to dredge a channel 400 feet wide and about 950 feet long through the shoal on the east side; accordingly an arrangement was made with the L. P. & J. A. Smith Company to do the necessary work at 18½ cents per cubic yard. The work was commenced April 30, and a channel of the required dimensions 21 feet deep was completed on June 16, a total of 30,437 cubic yards having been excavated at a cost of $5,630.85.

*East breakwater repairs.*—The repairs of the decks and side walls of the west 2,495 feet of the east breakwater, except the 200 feet to be removed in widening the entrance, has all been completed and the sheathing work, both above and below water on the lake and harbor sides, is progressing at a favorable rate. All of the necessary materials to complete this work are now at hand.

The following is a summary of the work accomplished during the year and to date, as well as the total amount expended for the same periods:

| | During year. | Total to date. |
|---|---|---|
| Decks repaired, including spur ... linear feet | 158.00 | 2,401.00 |
| Filling stone in superstructure ... tons | | 4,255.34 |
| Yellow pine in decks ... feet, B. M | 17,732.00 | 262,444.00 |
| Hemlock in side walls ... do | 6,154.00 | 59,575.00 |
| Screw bolts and spikes in repairs ... pounds | | 25,000.00 |
| Sheathing hung below water, lake side ... linear feet | 1,367.00 | 1,555.00 |
| Sheathing hung below water, harbor side ... do | 1,512.00 | 1,825.00 |
| Sheathing bolted below water, lake side ... do | 1,457.00 | 1,457.00 |
| Sheathing bolted below water, harbor side ... do | 1,200.00 | 1,200.00 |
| Sheathing completed above water, lake side ... do | 512.00 | 512.00 |
| Sheathing completed above water, harbor side ... do | 1,223.00 | 1,425.00 |
| Oak used for sheathing below water ... feet, B. M | | 7,000.00 |
| Beech used for sheathing below water ... do | 88,098.00 | 96,176.00 |
| Oak used for sheathing above water ... do | 49,270.00 | 61,699.00 |
| Bolts, spikes, etc., used ... pounds | 30,000.00 | 30,000.00 |
| Cost, labor | $7,090.57 | $12,845.45 |
| Cost, materials and plant | $5,113.45 | $22,157.37 |
| Total | 12,204.02 | 35,002.82 |

*Improvement and enlargement of the harbor.*—The river and harbor act approved June 13, 1902, appropriated $2,800,000, to be expended under continuous contracts, for the improvement and enlargement of Cleveland Harbor by providing a safer and better entrance at the main entrance and by extending the breakwater eastward.

*Main entrance.*—The plan for this work provides for the construction of a new entrance 700 feet in width, 1,000 feet out in the lake beyond the present entrance, to be marked by a 60 by 100 foot pierhead, with concrete superstructure on the west side and a similar pierhead 60 by 60 feet on the east side. These pierheads are connected with the existing breakwater by converging rubble-mound breakwaters each 1,250 feet in length. A paved slope of rubblestone extends for 1,000 feet along the old breakwater beyond its junction with the new work. This work is being executed under a continuous contract with the L. P. & J. A. Smith Company, of Cleveland, Ohio, dated November 19, 1902, at an estimated cost of $645,854.45. Operations were commenced by these contractors in April, 1903, and have since been carried on in a rather desultory manner. The substructure crib for the west pierhead was sunk in place November 4, 1903, and the one for the east pierhead June 18, 1904; the foundation ridges for the west breakwater are practically up to grade and ready for shale lining; the whole of the outside foundation ridge and of 450 feet of the inside ridge of the east breakwater has been built up to —20 feet with small riprap stone, and 250 feet of the foundation ridge for the west protection has been built up to —14 feet. The foundation of the west pierhead was originally built up 6 inches above the required grade; the crib settled to 6 inches below grade in a few days after placing, and has since settled so that the north side is 9 inches and the south side 1 foot too low. The foundation of the pierhead on the east side was built up 1 foot too high, and after 3 weeks the crib is still from 1.2 to 1.7 feet too high.

These contractors are now doing what they should have done a year ago, and have assembled a plant of 8 barges, 3 tugs, and 3 derricks, having a floating capacity of about 5,000 tons, and will doubtless soon push their work at the rate required by their contract. The stone used for this work comes mainly from Kelley Island, although a small quantity of sandstone brought in on the cars from the Berea sandstone quarries is being used. A traveling derrick has been set up on the east breakwater for placing stone in the east protection work when the weather is too rough for boats to lie outside.

The following tabulation shows the estimated total quantities and cost of executing this contract and the total quantities and cost of work done during the year and to date:

| Items. | Contract price per unit. | Total estimated cost. | | Cost for year. | | Total cost to date. | |
|---|---|---|---|---|---|---|---|
| | | Quantity. | Cost. | Quantity. | Cost. | Quantity. | Cost. |
| *Two pierheads.* | | | | | | | |
| Hemlock timber...thousand.. | $26.75 | 455.000 | $12,171.25 | 450,868.00 | $12,047.34 | 450,868.00 | $12,047.34 |
| Beech timber...........do.... | 40.00 | 38,080 | 1,523.20 | 38,080.00 | 1,523.20 | 38,080.00 | 1,523.20 |
| Oak timber.............do.... | 50.00 | 3,500 | 175.00 | | | | |
| Observation chamber........ | | | 1,500.00 | | 470.21 | | 470.21 |
| Large riprap............tons.. | 1.50 | 8,000 | 12,000.00 | 11,382.63 | 17,073.95 | 11,382.63 | 17,073.95 |
| Small riprap............do.... | 1.24 | 18,000 | 22,320.00 | 11,228.41 | 13,923.23 | 11,228.41 | 13,923.23 |
| Small paving stone.....do.... | 3.50 | 500 | 1,750.00 | | | | |
| Bolts, tie rods, etc....pounds.. | .04 | 100,000 | 4,000.00 | 93,724.00 | 3,748.96 | 93,724.00 | 3,748.96 |
| Concrete blocks..cubic yards.. | 10.00 | 550 | 5,500.00 | | | | |
| Concrete mass..........do.... | 9.00 | 1,050 | 9,450.00 | | | | |
| Pipe and fittings.....pounds.. | .40 | 2,000 | 800.00 | | | | |
| Total..................... | | | 71,189.45 | | 48,786.89 | | 48,786.89 |
| *Two rubble-mound breakwaters.* | | | | | | | |
| Large riprap............tons.. | 1.50 | 45,000 | 67,500.00 | 11,681.99 | 17,522.99 | 16,278.39 | 24,410.09 |
| Heavy riprap............do.... | 1.55 | 37,500 | 58,125.00 | | | | |
| Small riprap............do.... | 1.30 | 85,000 | 110,500.00 | 8,066.4 | 10,486.32 | 8,636.4 | 11,227.32 |
| Paving, first-class.......do.... | 3.00 | 30,000 | 90,000.00 | | | | |
| Paving, second-class....do.... | 2.90 | 12,500 | 36,250.00 | | | | |
| Gravel, core filling....cu. yds.. | .70 | 75,000 | 52,500.00 | | | | |
| Sand, core filling.......do.... | .40 | 37,500 | 15,000.00 | | | | |
| Total..................... | | | 429,875.00 | | 28,009.31 | | 35,637.41 |
| *Riprap protection for present breakwaters.* | | | | | | | |
| Large riprap............tons.. | 1.50 | 44,000 | 66,000.00 | 3,032.4 | 4,548.60 | 3,032.4 | 4,548.60 |
| Small riprap............do.... | 1.30 | 14,000 | 18,200.00 | | | | |
| Paving, second-class....do.... | 2.90 | 12,000 | 34,800.00 | | | | |
| Gravel, core filling...cu. yds.. | .70 | 28,000 | 19,600.00 | | | | |
| Total..................... | | | 138,600.00 | | 4,548.60 | | 4,548.60 |
| *Removing and repairing end of east breakwater.* | | | | | | | |
| Removing old breakwater, cubic yards.............. | .50 | 9,500 | 4,750.00 | | | | |
| Hemlock timber...thousand.. | 40.00 | 2,000 | 80.00 | | | | |
| Oak timber.............do.... | 100.00 | 7,000 | 700.00 | | | | |
| Large riprap............tons.. | 1.50 | 400 | 600.00 | | | | |
| Bolts, tie rods, etc....pounds.. | .06 | 1,000 | 60.00 | | | | |
| Total..................... | | | 6,190.00 | | | | |
| Total cost.................. | | | 645,854.45 | | 81,344.80 | | 88,972.90 |

*East breakwater extension.*—The plan for this work provides for the construction of a rubble-mound breakwater beginning at a 60 by 60 foot pierhead in the extension of the main portion of the existing breakwater and 200 feet west of the present terminus of its shore arm, leaving an entrance 550 feet wide in the clear, and extending thence eastward 2 miles, more or less, as far as the funds provided will allow. The work is being executed under two continuous contracts, dated November 20, 1902, with Hughes Brothers & Bangs, of Syracuse, N. Y., at a total estimatad cost of $1,971,018.40. Active operations under these contracts were commenced on May 4, 1903, and have since been prosecuted with considerable energy, although the rate of progress has not yet reached the contract requirements. Work for the season of 1903 was shut down December 3, and for the present season was commenced April 13. The 60 by 60 foot substructure crib for the pierhead which marks the beginning of the breakwater was successfully sunk in place December 3, 1903. This crib was nearly 1 foot above the proper grade when first sunk, but has since settled so that the northeast and southwest corners are almost exactly at grade, while the northwest corner is 2½ inches low and the southeast corner 2½ inches high. The west half of the first 1,000-foot section is now ready for the small stone filling under the paving, and it is expected to begin paving before August 1; the remainder of the section has been built up to about —15. In the second and third sections the lower ridges are finished, lined with shale, and partially filled with lake sand. In the fourth and fifth sections the lower ridges are ready for finishing. In the sixth section the lower ridges are up to —27 feet for 500 feet. The lake-sand core filling in the first and second sections was commenced on August 5 and continued until November 3; it was observed from time to time while this material was being deposited that about 20 per cent was lost, and after the protracted storms of October 14 to 29 it was found that the upper heavy riprap ridges had settled down materially into the sand filling on which they rested. A survey made to determine the nature and extent of this settlement disclosed the fact that where the surface of the sand core had been above —25 feet it had been more or less disturbed and the actual measurement of the material in place between the ridges showed that 20 per cent of the sand deposited had escaped; a rough estimate, based on the percentage of voids in the foundation ridges and sounding beyond the ridges, indicated quite clearly that most of the lost material had gone to fill the interstices between the stones and to form a slope along the outside edge of the ridges, and that in this manner practically all of the missing material could be accounted for. In view of these conditions, it was suggested that the inner slope of the foundation ridges be covered with a heavy layer of coarse core filling instead of small riprap stone, as originally intended, and that the quantity of lake-sand core be proportionally decreased; the necessary coarse material not being at hand, the deposition of lake sand was then suspended, it having been practically decided to recommend the adoption of this change in the method of construction when work was resumed again this spring. This modification, with others described later, was adopted by authority of the Chief of Engineers on April 28 of this year, and has since been followed in the work. After a very thorough canvas of the situation during the winter our contractors decided to use shale for the coarse core filling, and through an arrangement with the contractors engaged in excavating in the Black River at Lorain about 8,000 cubic yards of shale was brought from there in May; at the same time, through an agreement with the owners of the dredge *Gladiator*, arrangements were completed for digging 100,000 cubic yards of shale from the bed of Rocky River. The plant employed at Rocky River is particularly well adapted to this class of work and a satisfactory supply of shale has since been available; the total delivered by this plant since May 20 is 18,500 cubic yards, or at the rate of 750 cubic yards for each working day. It is expected to increase this output to 1,200 cubic yards per working day, or about 20,000 cubic yards per month. The shale has been used to build up the first section which is now practically ready to receive the small riprap covering for a length of 500 feet, and to line the foundation ridges in the second and third sections preparatory to filling with sand. It is the intention of the contractors to prepare a short section and to begin paving the slopes at the earliest possible time.

The Johnson Island quarries, from which all of the stone for the work is obtained, have developed into exceptionally good quarries for this class of material and are now opened up and equipped so as to afford a loading capacity of 2,000 tons per working day; photographs of this quarry, recently taken, are transmitted herewith. The contractors state that these quarries are much better in many respects, and particularly for paving stone, than those operated by them at Windmill Point, Canada, in connection with the construction of the Buffalo breakwater. The plant employed has been materially added to during the year by the acquisition of scows and derricks used last season on the Buffalo work, and will soon be still further increased by the arrival of three 1,500-ton barges with derricks on each end, with a large ocean-going tug which are now on the way from the Atlantic coast to take part in the work. When these barges reach here the contractors will have 10 deck scows, 6 dump scows, 4 derricks, and 3 tugs, making a combined capacity of over 10,000 tons.

The following summary shows the character, estimated total quantities, and cost of completing these contracts, as well as the character, quantities, and cost of the work accomplished during the year and the totals to date:

| Items. | Contract price per unit. | Total estimated cost. | | Cost for year. | | Total cost to date. | |
|---|---|---|---|---|---|---|---|
| | | Quantity. | Cost. | Quantity. | Cost. | Quantity. | Cost. |
| *Pier head.* | | | | | | | |
| Hemlock timber......M feet.. | $28.00 | 180,000 | $5,040.00 | 177,368.00 | $4,966.30 | 177,368.00 | $4,966,30 |
| Oak timber.............do.... | 50.00 | 1,680 | 84.00 | .......... | .......... | .......... | .......... |
| Beech timber...........do.... | 45.00 | 16,320 | 734.40 | 16,320.00 | 734.40 | 16,320.00 | 731.40 |
| Large riprap............tons.. | 1.30 | 3,000 | 3,900.00 | 2,000.00 | 2,600.00 | 2,000.00 | 2,600.00 |
| Small riprap............do.... | 1.14 | 6,500 | 7,410.00 | 5,000.00 | 5,700,00 | 5,000.00 | 5,700.00 |
| Small paving stone......do.... | 4.00 | 250 | 1,000.00 | .......... | .......... | .......... | .......... |
| Bolts, tie rods, etc....pounds.. | .04 | 40,000 | 1,600.00 | 37,639.00 | 1,505.56 | 87,639.00 | 1,505.56 |
| Concrete blocks..cubic yards.. | 11.00 | 250 | 2,750.00 | .......... | .......... | .......... | .......... |
| Concrete mass..........do.... | 8.00 | 500 | 4,000.00 | .......... | .......... | .......... | .......... |
| Wrought-iron pipe....pounds.. | .50 | 1,000 | 500.00 | .......... | .......... | .......... | .......... |
| Total.................... | ....... | .......... | 27,018.40 | .......... | 15,506.26 | .......... | 15,506.26 |
| *Rubble Mound breakwater, western division.* | | | | | | | |
| Heavy riprap............tons.. | 1.35 | 75.000 | 101,250.00 | 746.50 | 1,007.78 | 746.50 | 1,007.78 |
| Large riprap............do.... | 1.30 | 190,000 | 247,000.00 | 94,642.60 | 123,035.88 | 112,254.40 | 145,930.72 |
| Small riprap............do.... | 1,14 | 175,000 | 199,500.00 | 50,879.39 | 58,002.50 | 53,141.75 | 60,581.60 |
| Paving, first class.......do.... | 2.75 | 60,000 | 165,000.00 | .......... | .......... | .......... | .......... |
| Paving, second class.....do.... | 2.70 | 25,000 | 67,500.00 | .......... | .......... | .......... | .......... |
| Core filling, shale..cubic yds.. | .70 | 200,000 | 140,000.00 | 27,374.00 | 19,161.80 | 27,374.00 | 19,161.80 |
| Core filling, sand........do.... | .40 | 100,000 | 40,000.00 | 46,375.20 | 18,550.08 | 46,942.80 | 18,777.12 |
| Totals.................... | ....... | .......... | 960,250.00 | .......... | 219,757.54 | .......... | 245,459.02 |
| *Rubble Mound breakwater, eastern division.* | | | | | | | |
| Heavy riprap............tons.. | 1.35 | 75,000 | 101,250.00 | .......... | .......... | .......... | .......... |
| Large riprap............do.... | 1.30 | 190,000 | 247,000.00 | .......... | .......... | .......... | .......... |
| Small riprap............do.... | 1.14 | 175,000 | 199,500.00 | .......... | .......... | .......... | .......... |
| Paving, first class.......do.... | 2,75 | 60,000 | 165,000.00 | .......... | .......... | .......... | .......... |
| Paving, second class....do.... | 2.70 | 25,000 | 67,500.00 | .......... | .......... | .......... | .......... |
| Core filling, shale..cubic yds.. | .70 | 225,000 | 157,500.00 | .......... | .......... | .......... | .......... |
| Core filling, sand........do.... | .40 | 115,000 | 46,000.00 | .......... | .......... | .......... | .......... |
| Total.................... | ....... | .......... | 983,750.00 | .......... | .......... | .......... | .......... |
| Total cost................ | ....... | .......... | 1,971,018.40 | .......... | 235,263.80 | .......... | 260,965.28 |

*Modification of cross section.*—In April, after a very thorough consideration of the causes which probably lead up to the failure of a portion of the rubble-mound breakwater at Buffalo, and the comparative conditions of the lake bottom at Cleveland as developed by soundings and the driving of piles along the line of the proposed work, and also from a consideration of the settlement and escape of the lake-sand filling used in the first and second sections, it was recommended that the cross section of the rubble-mound breakwater for this harbor, as well as for the other harbors in the district where rubble-mound construction is being used, be modified as shown by the accompanying cross section. The modified section is thought to conform more nearly than the original one to the existing conditions, in that by moving the top of the structure 10 feet lakewards the center of pressure, due to the weight of the structure and force of the seas striking it, is better distributed over the base, and the resulting slopes provide greater stability and can be more certainly and easily constructed. The effect of the modification is to increase the cost somewhat by adding to the quantity of foundation stone and coarse core filling while decreasing the quantity of lake sand and, to a slight extent, the slope pavement; the amount of this increase is estimated at approximately $25,000, and is taken into consideration in the above tabulation.

*Injuries to and condition of existing works.*—There have been no cases of serious injury to the works in the harbor during the past year. It has been necessary, however, from time to time to caution vessels mooring to the east breakwaters and to order them to put out fenders and proper protections to the work. On June 15 the steamer *Louisiana* ran against the east breakwater and disabled the machine used for bolting sheathing, causing damage to the amount of $68.23.

A very considerable movement is noticeable between adjacent cribs in the west breakwater whenever there is any sea running; many of the joints between the blocks in the concrete superstructure have been more or less disfigured by this cause, and it seems probable that the old crib substructure will eventually be materially weakened by this movement. I would therefore suggest the advisability of protecting the entire length of the west breakwater by a filling of large riprap stone along the lake side, and of further strengthening the substructure cribs themselves by sheathing them with hard-wood plank below the water line on the harbor side.

The cost of this work is estimated as follows:

| | |
|---|---|
| 5,340 linear feet 3 by 12 inch by 12 foot beech plank, 192,640 feet B. M., at $130 per M feet B. M. | $25,043.20 |
| 42,720 ¾ by 14 inch lag screws, 77,100 pounds, at $0.04 per pound | 3,084.00 |
| 3,500 linear feet, 35,000 tons riprap, at $1.50 per ton | 52,500.00 |
| 10 per cent for supervision and contingencies | 8,062.72 |
| Total | 88,689.92 |

The shore end of the west breakwater, between the west opening and the harbor line, 700 feet in length, as shown by the accompanying photographs, is going to pieces rapidly, and unless steps are soon taken to strengthen and repair this section of the old breakwater it is likely to be breached during heavy weather and suffer injury that will greatly increase the cost of the necessary repairs. The cost of repairing this structure so as to conform with the remainder of the west breakwater is estimated as follows:

| | |
|---|---|
| 34,000 cubic feet concrete blocks, at 40 cents per cubic foot | $13,600 |
| 5,150 cubic yards concrete, in mass, at $8 per cubic yard | 41,200 |
| 8,000 cubic yards old crib superstructure removed, at 50 cents per cubic yard | 4,000 |
| 700 linear feet top prepared, at $5 per linear foot | 3,500 |
| 50,000 feet B. M. lumber for base, at $30 per M feet B. M. | 1,500 |
| 1,500 cubic yards stone back filling, at $1 per cubic yard | 1,500 |
| 7,000 tons riprap protection, at $1.50 per ton | 10,500 |
| 50,000 feet B. M. sheathing, at $140 per M feet B. M. | 7,000 |
| 18,000 feet B. M. oak fenders, at $50 per M feet B. M. | 900 |
| 10 per cent for supervision and contingencies | 8,370 |
| Total | 92,070 |

*Surveys.*—The survey of all the area covered and protected by the proposed extension of the east breakwater to Gordon Park was completed in September, 1903, and has since been plotted on three sheets to a scale of 1 foot to 2,000 feet. This survey comprises over 15,000 soundings, of which one-third were actually located.

The area between the existing breakwaters and the harbor line was sounded through the ice in December and January. An area 1,500 feet wide on the east side of the entrance channel and 2,500 feet on the west side was similarly sounded in February, shortly after the freshet on January 21 and 22; a comparison between the soundings made before and after this freshet shows that owing to the force and volume of the flood a very large proportion of the material brought down by the river was carried through the harbor into the lake, and that only about 75,000 cubic yards were deposited inside of the breakwater. A comparison between the surveys made in January, 1902, and January, 1904, which covered the same territory, show a deposit of nearly 500,000 cubic yards over the area protected by the breakwaters, and indicate that small freshets do relatively more damage to the harbor in this respect than large ones.

Levels recently run to determine the settlement of the existing structures in the harbor show that very little change has taken place during the year; the west pier has settled 0.05 of a foot, the east pier shows no change, the west breakwater shows an average settlement of 0.02 of a foot, and the east breakwater 0.04 of a foot on the lake side.

*Dump grounds.*—The area over which materials may be deposited in the lake, under proper restrictions, comprises between 400 and 500 acres, lying between temporary waterworks cribs Nos. 1 and 2. The buoy which marks the immediate vicinity in which dumping should be done has been moved from time to time so as to prevent

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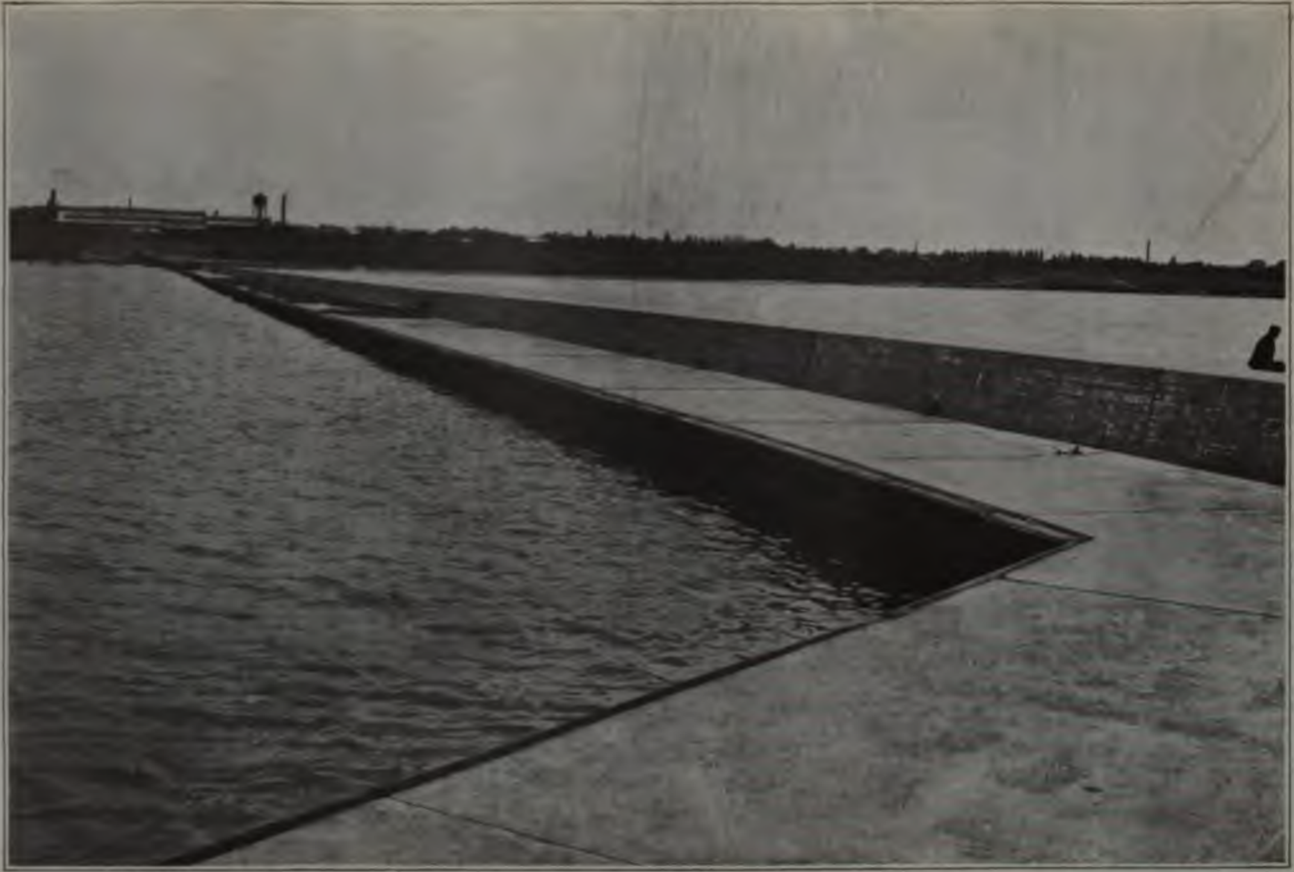
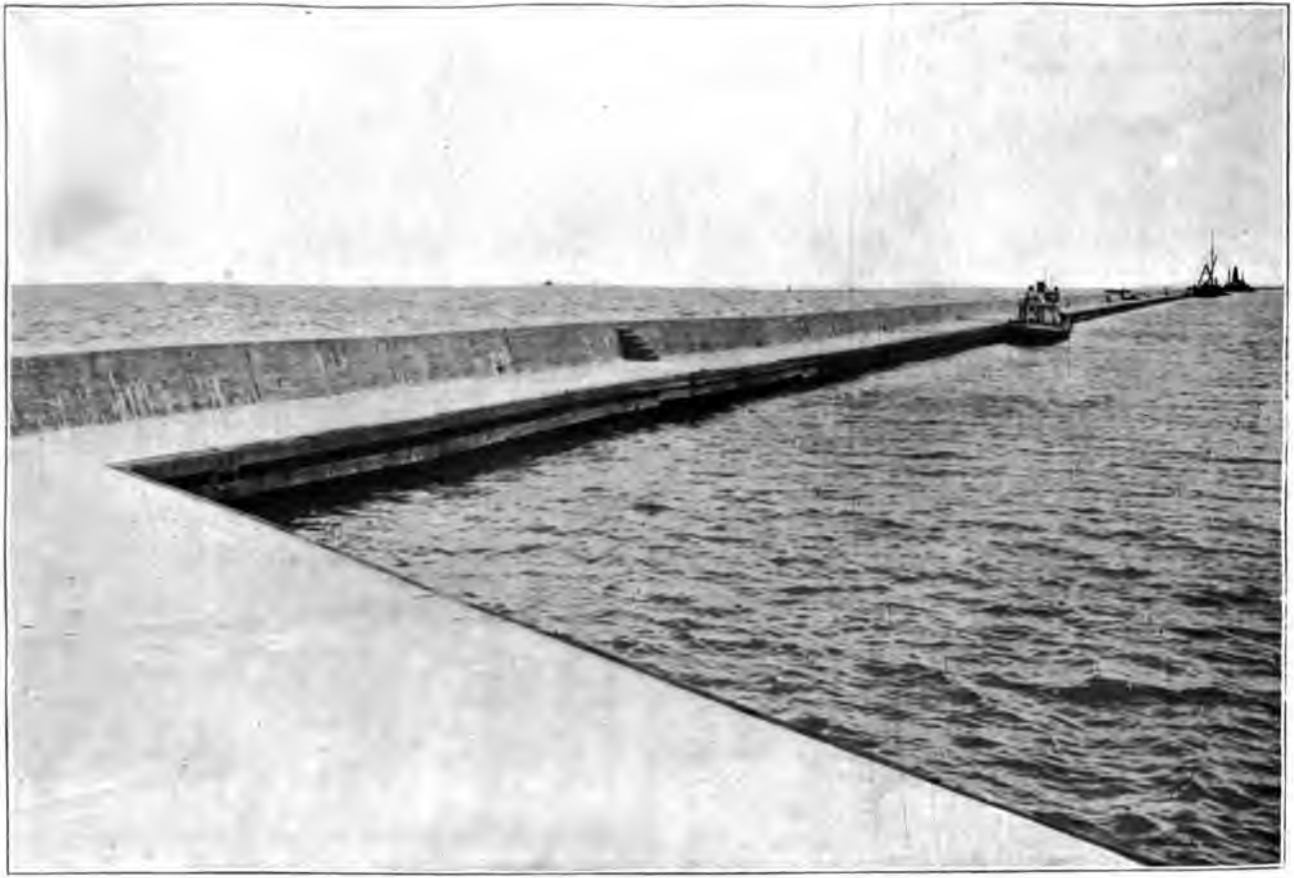
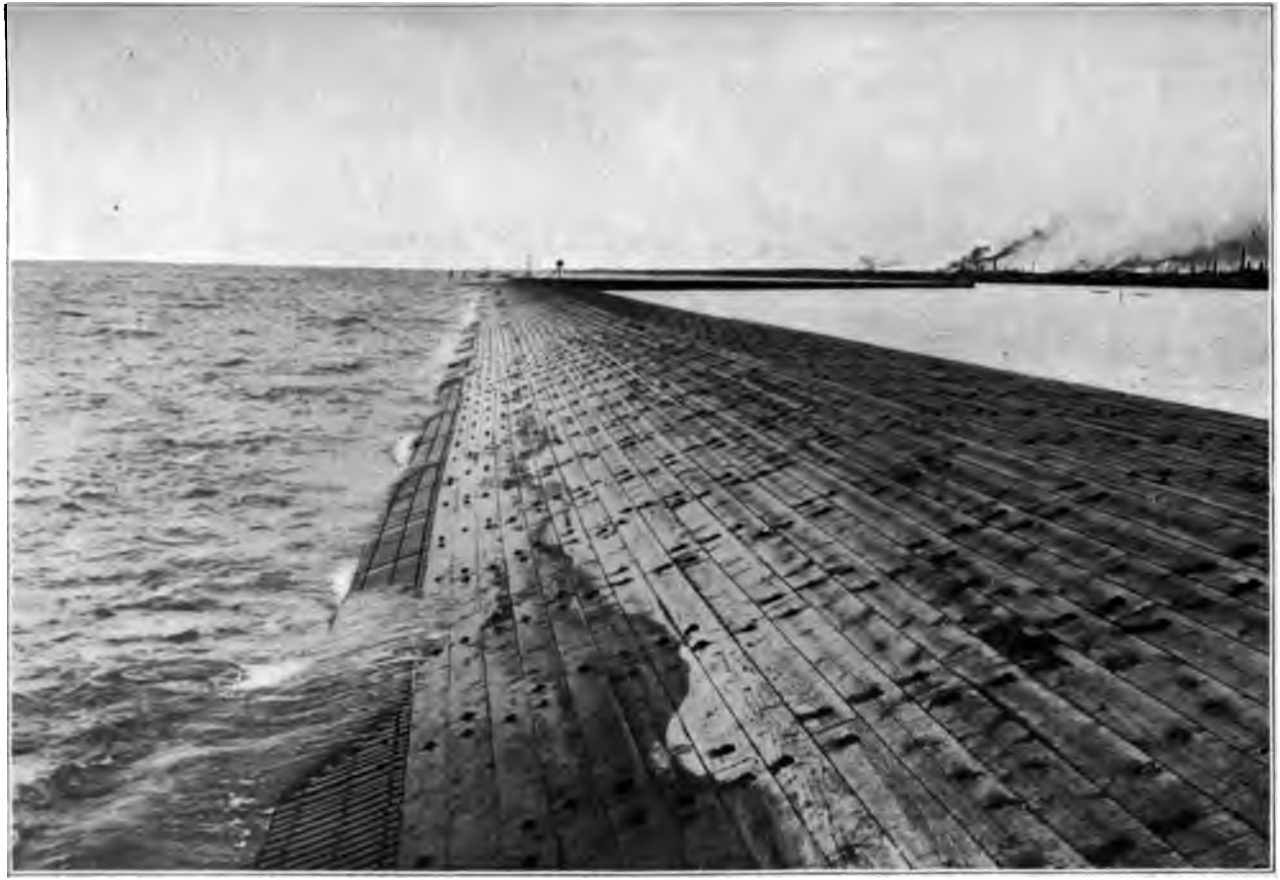
[illegible] HARBOR, [illegible] WEST BREAKWATER [illegible]



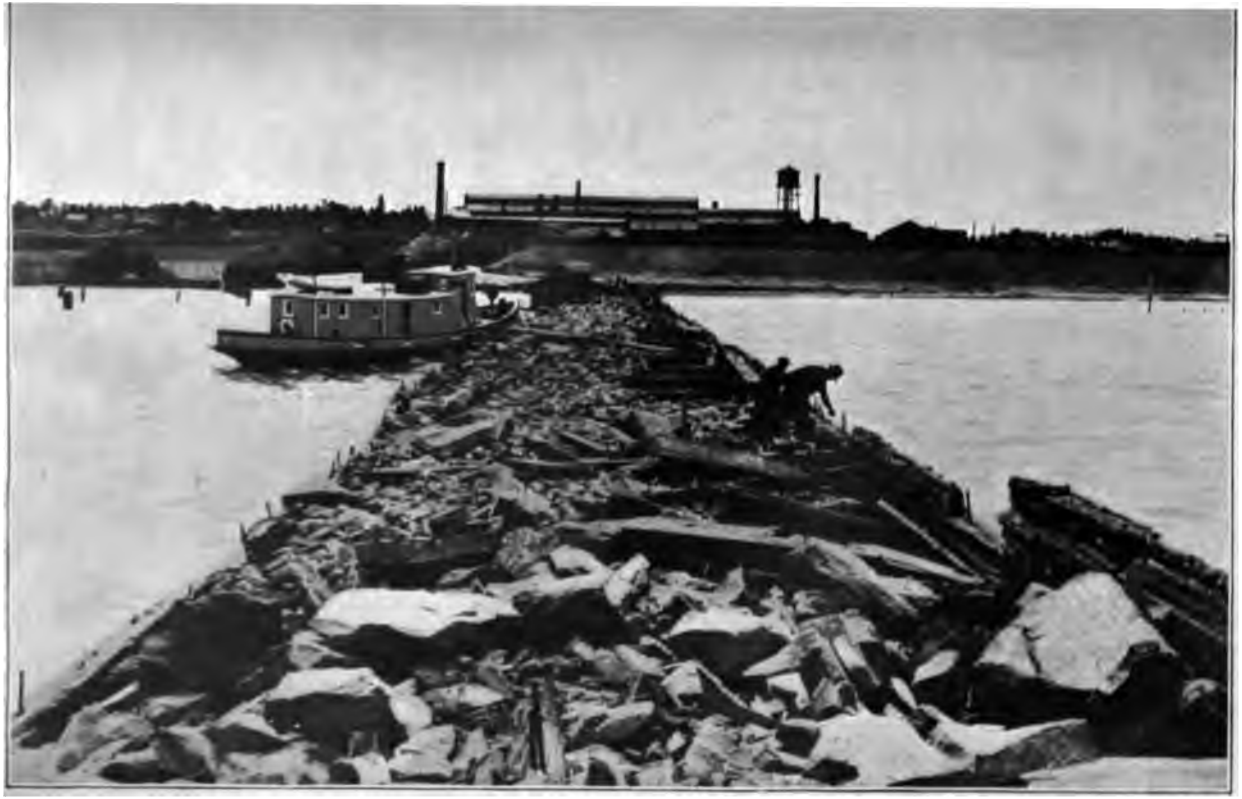
CLEVELAND HARBOR, OHIO. SHORE ARM OF WEST BREAKWATER.



CLEVELAND HARBOR, OHIO. WEST BREAKWATER.



CLEVELAND HARBOR, OHIO. EAST BREAKWATER.



CLEVELAND HARBOR, OHIO. VIEW SHOWING CONDITION OF SHORE END OF WEST BREAKWATER.

the grounds being filled above −35 feet. An investigation recently made by a sanitary expert in the employ of the city of Cleveland indicates that this dump ground by reason of its proximity to the new intake crib is a source of quite serious pollution to the water supply of the city, and application has been recently made by the city authorities to establish a new dump ground east of Doan street and 3 miles off the shore; this ground will be fully 6 miles from the new intake crib and from the main entrance to the harbor and will be in about 50 feet of water.

*Lake levels.*—The highest, lowest, and mean elevation of the water surface at the Cleveland gauge for each month of the year, with reference to the mean lake level of 1860 to 1875, are given in the following table:

| | Higest elevation. | Lowest elevation. | Mean elevation. |
|---|---|---|---|
| **1903.** | | | |
| July | +1.20 | −0.16 | +0.21 |
| August | + .45 | − .43 | − .01 |
| September | + .30 | − .60 | − .18 |
| October | − .60 | −1.15 | − .52 |
| November | − .27 | −1.62 | −1.00 |
| December | −1.00 | −2.12 | −1.47 |
| **1904.** | | | |
| January | − .55 | −2.00 | −1.55 |
| February | −1.13 | −1.78 | 1.50 |
| March | − .25 | −1.55 | − .90 |
| April | +1.78 | − .54 | + .16 |
| May | +1.22 | − .07 | + .39 |
| June | + .80 | + .25 | + .562 |
| For fiscal year 1904 | +1.22 | −2.12 | − .481 |

The plane of reference for the Cleveland gauge is the high water of 1834, 575.107 feet above mean tide at New York. The zero of the gauge is set at the mean level for 1860 to 1875, 2.34 feet below the plane of reference and 572.767 feet above mean tide at New York.

*Work done by the city.*—The city of Cleveland, through its department of harbors and docks, has in charge the improvement and maintenance of the channel in the Cuyahoga and Old rivers and the construction of docks and wharves in front of city property in the lake. The Erie street dock on the lake front is now nearly ready for filling and has cost to date $155,177. The dock lines for the straightening of the river channel at Jefferson street have been built at a cost of $26,500, and it is expected to begin dredging out the new channel, which is estimated will amount to 250,000 cubic yards within a short time. About 175,000 cubic yards of material have been dredged from the river during the year at a cost of about $30,000. The total amount expended by the city during the year for these improvements has been $75,000.

Plans have been approved for the extension of deep-water navigation to the plant of the Cleveland Furnace Company 3½ miles above the present head of navigation. The estimated cost of this work, which is to be borne jointly by the city and the property owners directly benefited, is $1,500,000, and from three to five years will be required for its completion.

The whole southern drainage area of Lake Erie was visited by a flood of unusual severity in January. This flood, which caused considerable damage to shipping and to property in the flats, is quite fully described and discussed in a special report covering also the Black and Grand rivers submitted herewith.

Observations to determine the flow and quantity of sediment carried out to the lake by the Cuyahoga River have been continued through the year and are made the subject of a special report.

The work in Cleveland Harbor has been done under the general supervision of Mr. L. C. Schnell, junior engineer, assisted by Inspector F. S. Burgess on the west breakwater work, Inspector A. Mommertz on the east breakwater extension, and Inspector W. S. Van Horn on the main entrance work.

Very respectfully,

G. T. Nelles,
*United States Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

## P P 8.

## IMPROVEMENT OF FAIRPORT HARBOR, OHIO.

For a description of the location, projects of improvement, and the general conditions at this harbor see pages 2676 and 2677, Report of Chief of Engineers, 1898.

The engineering problem presented by the harbor of Fairport was very thoroughly discussed in the Annual Report of the Chief of Engineers for 1903. See pages 2084 to 2087, inclusive, of the report. This discussion will not be repeated here.

As a result of the discussion it was recommended that the original plan be modified, first, by extending the west breakwater so as to connect with the shore, thus cutting off the current and the sand supply from the beach; second, by constructing the outer portion of the breakwater parallel to the jetty so as to keep the outer end farther away from the channel. The object of the modified structure is to arrest the movement of sand from the westward, thus acting as a groin, and at the same time to serve as a breakwater to protect the entrance from westerly storms. A structure of the rubble mound type is recommended, and in the interest of economy it is proposed not to pave the slopes, but to build the upper portion of the structure of large blocks of stone of from 8 to 12 tons in weight, deposited so as to secure the general form of cross-section desired, but with no attempt to secure a smooth and regular surface.

The estimated cost of completing the west breakwater in accordance with this plan is $278,000, and this will leave a sufficient sum from the original estimate for the completion of the project for building the east breakwater if this structure is found to be desirable and necessary.

During the year work has been in progress under the contract with The Donnelly Contracting Company, of Buffalo, N. Y., for rebuilding and repairing the inner ends of both jetties and for sheathing the outer portions with hard-wood plank. The repair work in so far as relates to the inner end of the jetties has been completed, and about 24 per cent of the sheathing has been accomplished. It is thought that the entire work will be finished before the end of the present working season.

During the month of January, 1904, an unusual flood, accompanied by ice gorges, occurred in the Grand River. A very solid ice dam was formed at the outer end of the jetties, which raised the water in the river 8 or 9 feet, until it flowed over the top of them. As these structures were not built to act as dams, some of the water found its way beneath them, scouring out the material and causing them to settle unequally and disturbing their alignment. The result was not sufficient to impair their usefulness, however, and the effect of the unequal settlement can be counteracted by building them up again to grade. The flood water found its way under the ice dam, scouring out the bed of the channel and depositing the excavated material in a bar beyond the dam. This left the harbor when the ice went out completely closed, as the depth of water on the bar was nowhere greater than 8 or 9 feet. The U. S. dredge *Maumee* was sent to restore this channel, which it did by the excavation of about 30,000 cubic yards of material.

For a detailed description of the work actually accomplished, together with a tabulated statement of the cost and quantity of material used, attention is respectfully invited to the report of Assistant Engineer G. T. Nelles, which is transmitted herewith.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $168,223.22 |
| June 30, 1904, amount expended during fiscal year: | | |
| For maintenance of improvement | $82,190.69 | |
| Allotment for new dredge | 25,000.00 | |
| | | 107,190.69 |
| July 1, 1904, balance unexpended | | 61,032.53 |
| July 1, 1904, outstanding liabilities | | 2,174.19 |
| July 1, 1904, balance available | | 58,858.34 |
| July 1, 1904, amount covered by uncompleted contracts | | 51,674.58 |
| Amount (estimated) required for completion of existing project | | 480,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $278,000.00 | |
| For maintenance of improvement | 18,000.00 | |
| | | 296,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

### AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | |
|---|---|
| March 3, 1825 | $1,000.00 |
| May 20, 1826 | 5,620.00 |
| May 19, 1828 | 9,135.11 |
| April 23, 1830 | 5,563.18 |
| March 2, 1831 | 5,680.00 |
| July 3, 1832 | 2,600.00 |
| June 28, 1834 | 10,000.00 |
| July 2, 1836 | 6,000.00 |
| July 7, 1838 | 10,000.00 |
| June 11, 1844 | 10,000.00 |
| August 13, 1852 | 10,000.00 |
| June 28, 1864 | 24,435.24 |
| June 23, 1866 | 24,072.00 |
| March 2, 1867 | 60,000.00 |
| June 23, 1874 | 20,000.00 |
| March 3, 1875 | 15,000.00 |
| August 14, 1876 | 5,000.00 |
| June 18, 1878 | 5,000.00 |
| June 14, 1880 | 3,000.00 |
| March 3, 1881 | $10,000.00 |
| August 2, 1882 | 10,000.00 |
| July 5, 1884 | 10,000.00 |
| August 5, 1886 | 18,750.00 |
| August 11, 1888 | 10,000.00 |
| September 19, 1890 | 20,000.00 |
| July 13, 1892 | 35,000.00 |
| August 18, 1894 | 20,000.00 |
| June 3, 1896 | 30,000.00 |
| March 3, 1899 | 100,000.00 |
| July 31, 1900 (allotment) | 3,000.00 |
| April 15, 1902 (allotment) | 1,800.00 |
| June 13, 1902 | 200,000.00 |
| Total | 700,655.53 |
| Expended to June 30, 1904 | 639,623.00 |
| Unexpended July 1, 1904 | 61,032.53 |

### LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for reconstructing and repairing parts of east and west piers.*

Name of contractor: The Donnelly Contracting Company, Buffalo, N. Y.
Date of contract: September 29, 1902.
Date of approval: October 30, 1902.
Date of commencement: November 3, 1902.
Date of completion: December 1, 1904.

### COMMERCIAL STATISTICS.

The following statistics for the year 1903 relative to the commerce of the harbor of Fairport, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Iron ore | 1,606,463 | Coal and coke | 319,895 |
| Coal and coke | 378,096 | Iron and steel, structural | 745 |
| Flour | 97,931 | Miscellaneous | 17,478 |
| Grain and produce | 16,371 | | |
| Lime, plaster, and cement | 601 | | |
| Lumber, logs, etc | 4,162 | | |
| Sand and gravel | 1,000 | | |
| Stone | 13,219 | | |
| Miscellaneous | 24,777 | | |
| Total | 2,142,620 | Total | 338,118 |

| Total freight tonnage: | |
|---|---|
| 1903 | 2,480,738 |
| 1902 | 2,330,480 |
| Increase | 150,258 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 423 | 871,877 |
| Departing | 416 | 881,180 |

| Total registered tonnage: | |
|---|---|
| 1903 | 1,753,057 |
| 1902 | 1,903,811 |
| Decrease | 150,754 |

Draft of largest vessels using harbor, 19 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

### REPORT OF MR. G. T. NELLES, ASSISTANT ENGINEER.

CLEVELAND, OHIO, *June 30, 1904.*

MAJOR: I have the honor to submit the following report of operations carried on under my local supervision at Fairport Harbor, Ohio, during the fiscal year ending June 30, 1904.

The improvement of this harbor is being made under project dated March 31, 1896, published in the Annual Report of the Chief of Engineers of that year, pages 2956–2958. The project contemplates the construction of a small harbor of refuge in the lake at the mouth of the Grand River. Two breakwaters are provided, starting from entrance pierheads placed 400 feet apart and 1,850 feet in the lake beyond the end of the present west pier. The west breakwater will run S. 25° W. 2,000 feet from the west pierhead and the east breakwater S. 30° E. 1,300 feet from the east pierhead. The total estimated cost of carrying out this project, as modified May 17, 1900, is $585,000, and a length of 828 feet at the inner end of the west breakwater has already been built of stone-filled timber cribs at a cost of about $125 per linear foot.

The effect of the construction of this length of breakwater was not such as to fully justify the hypothesis on which the project was based, therefore when the $200,000 appropriated by act of June 13, 1902, became available, it was decided, with the approval of the Chief of Engineers, to wait until the action of the breakwater could be more fully determined before making any further extensions, and in the meantime to apply the major portion of the sum available to the reconstruction and repair of the old piers, which were in a very dilapidated condition.

A contract was accordingly entered into September 29, 1902, with the Donnelly Contracting Company, of Buffalo, N. Y., for doing this work at an estimated cost of $133,910.95. Operations under this contract have been pushed with commendable energy during the past year and practically all of the work completed except part of the sheathing and the repairs of outer end of the piers. The sheathing work has been delayed by difficulty in securing capable divers and other causes. All of the sheathing plank (894 linear feet) has been spiked in place on the west pier and 24 linear feet across the outer end and 622.5 linear feet on the channel side has been completed by bolting. Three hundred and nine linear feet of sheathing has been spiked in place on lake side of east pier, but only 60 linear feet has been secured by bolting. Two crews of divers are now at work on the sheathing and the indications are good for completing it during the present season.

The following tabulation gives the character, estimated total quantities, and cost of the work to be done under the contract with the Donnelly Contracting Company, the character, quantities, and cost of the work done during the year, and the totals to date:

| Items. | Contract price per unit. | Total estimated cost. |  | Cost for year. |  | Total cost to date. |  |
|---|---|---|---|---|---|---|---|
|  |  | Quantity. | Cost. | Quantity. | Cost. | Quantity. | Cost. |
| *East pier reconstruction (580 linear feet).* |  |  |  |  |  |  |  |
| Removal of old pier .cu. yds.. | $0.50 | 7,500 | $3,750.00 | 763.00 | $381.50 | 7,033.00 | $3,516.50 |
| Dredging ..............do.... | .25 | 15,000 | 3,750.00 | 425.00 | 106.25 | 11,000.00 | 2,750.00 |
| Hemlock timber.. ...M feet.. | 28.50 | 640,000 | 18,240.00 | 422,298.00 | 12,035.49 | 632,244.00 | 18,018.95 |
| Old timber decking.....do.... | 22.50 | 22,000 | 495.00 | 4,963.00 | 111.67 | 4,963.00 | 111.67 |
| Beech timber..........do.... | 36.00 | 65,000 | 2,340.00 | 36,864.00 | 1,327.10 | 55,296.00 | 1,990.66 |
| Oak timber ............do.... | 46.25 | .......... | .......... | 6,960.00 | 321.90 | 6,960.00 | 321.90 |
| Bolts, tie-rods, etc ...pounds.. | .04 | 180,000 | 7,200.00 | 118,368.00 | 4,734.72 | 174,404.80 | 6,976.19 |
| Concrete blocks......cu. yds.. | 11.37 | 710 | 8,072.70 | 731.69 | 8,353.43 | 734.69 | 8,353.43 |
| Concrete mass .........do.... | 7.50 | 2,100 | 15,750.00 | 1,717.60 | 12,882.00 | 1,717.60 | 12,882.00 |
| Small riprap ...........tons.. | 1.33 | 10,500 | 13,965.00 | 6,308.00 | 8,389.64 | 8,608.00 | 11,448.64 |
| Total .................... | ........ | .......... | 73,562.70 | .......... | 48,643.70 | .......... | 66,369.94 |
| *West pier reconstruction (570 linear feet).* |  |  |  |  |  |  |  |
| Removal of old pier ..cu. yds.. | 1.00 | 3,500 | 3,500.00 | 2,286.2 | 2,286.20 | 3,301.8 | 3,301.80 |
| Other excavations......do.... | .25 | 1,800 | 450.00 | .......... | .......... | 1,518.0 | 379.50 |
| Sheet piling, complete..M ft.. | 50.00 | 170,000 | 8,500.00 | 67,080.0 | 3,354.00 | 148,440.0 | 7,422.00 |
| Old timber, decking ....do.... | 27.50 | 25,000 | 687.50 | 8,556.0 | 235.29 | 8,556.0 | 235.29 |
| Beech timber...........do.... | 46.00 | 7,000 | 322.00 | .......... | .......... | .......... | .......... |
| Oak timber ............do.... | 56.25 | .......... | .......... | 8,046.0 | 452.59 | 8,046.0 | 452.59 |
| Hard-wood piles ..linear feet.. | .35 | 17,500 | 6,125.00 | 300.0 | 105.00 | 18,300.0 | 6,405.00 |
| Pile rings and shoes..pounds.. | .075 | 10,000 | 750.00 | .......... | .......... | 783.0 | 58.73 |
| Bolts, tie-rods, etc ......do.... | .04 | 50,000 | 2,000.00 | 8,617.8 | 344.71 | 8,617.8 | 344.71 |
| Refilling pier, etc....cu. yds.. | 1.31 | 2,000 | 2,620.00 | 1,386.7 | 1,816.58 | 1,386.7 | 1,816.58 |
| Back filling, sand.......do.... | .44 | 1,500 | 660.00 | 604.0 | 265.76 | 604.0 | 265.76 |
| Concrete blocks.........do.... | 11.25 | 575 | 6,468.75 | 562.4 | 6,327.00 | 562.4 | 6,327.00 |
| Concrete mass ..........do.... | 7.50 | 1,200 | 9,000.00 | 1,218.7 | 9,140.25 | 1,218.7 | 9,140.25 |
| Sawed sandstone.....sq. feet.. | .44 | 3,800 | 1,672.00 | 3,705.0 | 1,630.20 | 3,705.0 | 1,630.20 |
| Total .................... | ........ | .......... | 42,755.25 | .......... | 25,967.58 | .......... | 37,779.41 |
| *Sheathing and repairing old piers.* |  |  |  |  |  |  |  |
| 3-inch beech plank .....M ft.. | 123.00 | 85,000 | 10,455.00 | 23,846.0 | 2,933.06 | 30,683.0 | 3,774.01 |
| Lag screws and washers..lbs.. | .04 | 30,000 | 1,200.00 | 5,431.0 | 217.24 | 7,470.4 | 298.82 |
| Pine plank..............M ft.. | 44.00 | 85,000 | 3,740.00 | .......... | .......... | .......... | .......... |
| Pine stringers...........do.... | 44.00 | 12,000 | 528.00 | .......... | .......... | .......... | .......... |
| Hemlock timber.........do.... | 29.00 | 30,000 | 870.00 | .......... | .......... | .......... | .......... |
| Bolts and spikes .....pounds.. | .04 | 20,000 | 800.00 | .......... | .......... | .......... | .......... |
| Total .................... | ........ | .......... | 17,593.00 | .......... | 3,150.30 | .......... | 4,072.83 |
| Total cost ................ | ........ | .......... | 133,910.95 | .......... | 77,751.58 | .......... | 108,222.18 |

The concrete work done by this firm was particularly satisfactory, the plant being well adapted to the purpose and the materials and workmanship exceptionally good. The following is a record of all the concrete work done during the year, the proportions being 1 cement, 2 sand, 2 gravel, and 4 unscreened broken stone:

| | Concrete blocks. | Concrete in mass. |
|---|---|---|
| | *Cubic yards.* | *Cubic yards.* |
| Cement (Lehigh Portland) | [a]209.00 | [b]555.00 |
| Beach sand | 418.00 | 1,110.00 |
| Gravel | 418.00 | 960.00 |
| Broken limestone | 836.00 | 1,920.00 |
| Total volume of materials | 1,881.00 | 4,545.00 |
| Resulting volume of concrete | 1,297.01 | 2,936.30 |
| Ratio of concrete to materials, per cent | 74.30 | 64.60 |
| Barrels of cement per cubic yard | 1.08 | 1.27 |

[a] 1,413 barrels.

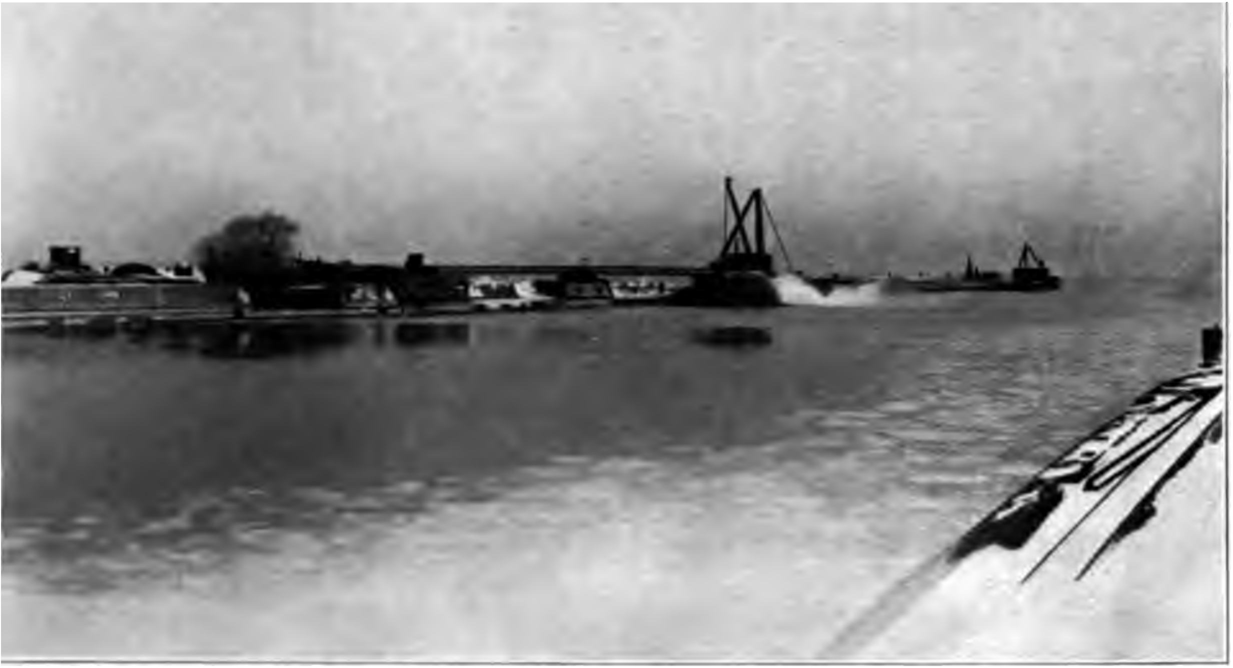
[b] 13,743 barrels.

It will be observed that the quantity of cement used per cubic yard at Fairport is considerably more than at Lorain. This is due to the different proportion of gravel, two parts being used to one of cement at Fairport and three parts to one of cement at Lorain. Also to the fact that the molds were not plastered at Lorain during the first two seasons and because a considerable length of the superstructure (600 linear feet) still requires finishing and plastering.

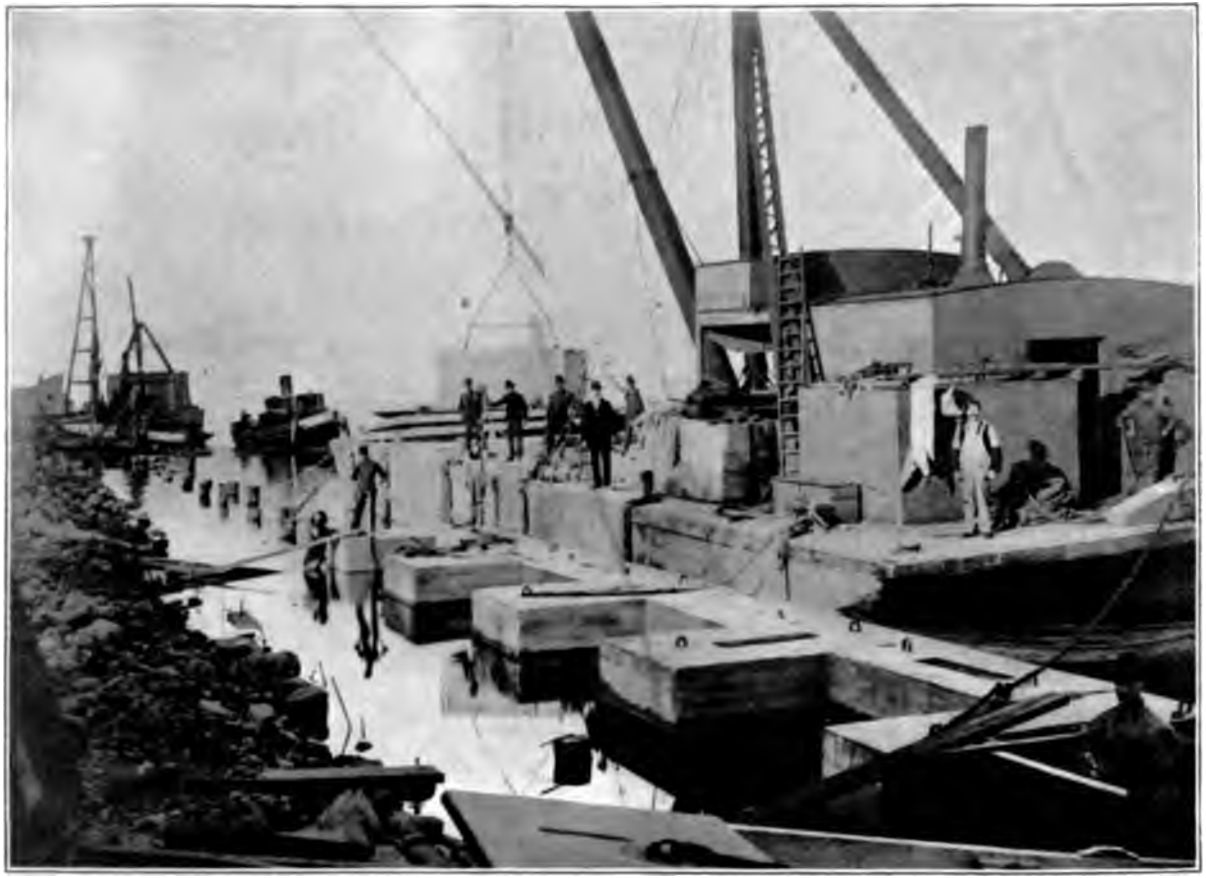
*Dredging.*—The freshet of January 21 and 22 caused a deep scour in the jettied channel beyond the life-saving station and for 500 feet in the prolongation of this channel beyond the end of the piers, and an unusual fill everywhere else over an area protected by the west breakwater; a bar on which the depth at the crest was only 6 feet was formed directly across the entrance to the harbor, beginning 600 feet beyond the end of the piers. Surveys made immediately before and after the January flood show a total fill of 45,000 cubic yards over the area between the west breakwater and the channel and a fill of 37,000 cubic yards on the bar in the prolongation of the channel over an area of only 200 by 300 feet. The scour in the prolongation of the jettied channel amounted to about 75,000 cubic yards in about 500 feet, and the fill on the outer bar and close to the west breakwater amounted to as much as 15 feet in some places. These conditions completely closed the entrance to the harbor to vessels drawing more than 9 feet, and in order to avoid delaying navigation early in the season, steps were taken for doing the necessary dredging by contract; the bids which were opened February 29 were all considered too high, and in view of the fact that the U. S. dredge *Maumee* was available for doing this work it was decided to bring her to Fairport as soon as the ice conditions would permit; she left Toledo April 17, reached Fairport on the 18th, and commenced dredging operations on the 21st. Owing to rough weather and the exposed position of the work, the progress made was not very satisfactory, and it was not until June 10 that the desired channel was completed through the bar; a narrow channel was made, however, during the first few days of the dredging operations, so that navigation was in no wise interfered with.

In addition to dredging at Fairport, the *Maumee* removed the wreck of the yacht *Idler*, which obstructed the channel near the end of the west pier, at a cost of $375, and also leveled off the wreck of the barge *L. L. Lamb*, which laid about three-fourths of a mile north-northwest from the light, on the end of the east pier, in 28 feet of water, so as to provide a clear depth of 24 feet over the highest part of the wreck. The cost of this work was $150. A total of 30,520 cubic yards of material was excavated by the *Maumee*, forming a channel 300 feet wide and 21 feet deep. The total cost of this work, including the cost of fitting out the dredge, wages for the whole of April, and towing from Toledo, was $3,765.25, or about 12⅓ cents per cubic yard. Owing to bad weather, less than one-half of the time was available for actual dredging, making the output of the dredge per working day about 1,100 cubic yards.

*New work.*—Surveys made during the year corroborate fully all previous statements in reference to the excessive and unusual movement of drift from the west and tendency to shoal in the vicinity of this harbor, and emphasize the necessity for carrying out the plan outlined in the last annual report. This plan contemplates the construction of rubble mound breakwaters without paved slopes, similar in cross section to the breakwater recently designed for the east breakwater at Lorain, extending out about 1,200 feet from the end of the present breakwater in a direction parallel to the line of the piers and connected at the inner end of the present break-



FAIRPORT HARBOR, OHIO. GENERAL VIEW OF WEST PIER.



FAIRPORT HARBOR, OHIO. WEST PIER CONSTRUCTION.

either by the waves or the ice when it was covered by not less than 10 feet of water. During the early part of the year, while the contractor was still at work, he built up a portion of this small-stone core to within 2 or 3 feet of the water surface. He was not allowed to bring up more than a length of 400 feet in this way, but it seemed certain that he could protect this much by pavement before the close of the season. But, as above stated, work was suspended, and only an insignificant amount of pavement had been placed. The small stone was not disturbed until the ice formed in the winter, but the movement of ice floes cut it down to a level of about 8 feet below the water surface, and some of the stone was carried outside of the volume of the finished breakwater, and hence lost to the work. Careful comparative surveys indicate that the amount thus lost was about 1,900 tons. It has not yet been determined whether this loss shall be charged to the contractor or not. The stone had already been paid for by the United States. A special report will be submitted upon this subject.

The breakwaters at Ashtabula, as well as at Lorain and Cleveland, were to be built in accordance with a plan prepared by a Board of Engineers for this purpose. The profile was not such as to give a good distribution of the weight upon the foundation, the slope toward the harbor being very much steeper than that toward the lake. From 8 feet below water up to the crest the slope on the harbor side was 4 on 3, a very difficult slope to build, and one so steep that the pavement would slide on its foundation and practically act as an inclined retaining wall. A full report upon this subject was made to the Department and authority was granted to reduce this slope on the harbor side of all of these breakwaters to a uniform slope of 1 on 1.3, and to increase the slope on the lake side from 1 on 2½ to 1 on 2. This involved no change in the quantity of material or method of construction.

The river and harbor act of June 13, 1902, appropriated the sum of $200,000 for continuing the improvement and for maintenance of this harbor. Twenty thousand dollars of this sum was authorized by the act to be applied toward the purchase of a hydraulic dredge. It was intended to apply about $150,000 of the remainder to completely rebuilding the west jetty, which was in a ruinous condition. While plans were in preparation for this work, and before the project had been submitted, the Secretary of War, under authority of law, gave permission to the Pittsburgh, Youngstown and Ashtabula Railroad Company to completely remove the west jetty and to replace the same by a bulkhead constructed 60 feet farther to the west, thus increasing the width of the channel. This company is the owner of the land lying immediately westward of the jetty. The permit requires the railroad company to provide suitable places for range lights which were formerly built upon the jetty, and to maintain the existing structure until it is replaced by the new one. Hence, there is no occasion for the expenditure of the $150,000 in this proposed repair.

A project was prepared and submitted October 7, 1902, for applying this sum to the extension of the west breakwater 1,500 feet shoreward, the style of construction to be a modified rubble mound. It was held, however, that this work being outside of the approved project could not be done without the authority of Congress. Congress has not yet sanctioned the work, but the expenditure would seem to be best for the improvement of this harbor, because it enables this railroad company, in case the work is done, to construct extensive docks under its shelter on the lake front to the westward of the present jetty.

Additional wharf room is greatly needed at this harbor because its resources are now taxed to the very limit to accommodate the business of the port.

Soon after the permit was granted the railroad company proceeded to remove about 1,000 feet of the shoreward end of the jetty and to replace it by a bulkhead as required in its permit. The work has been completed and the channel between this length of bulkhead and the original channel has been deepened to 21 feet. It was this operation of the railroad company that interfered with the storage ground of the contractor, but it does not appear that the United States or anyone else had undertaken to afford him the use of this piece of water front.

During the year the outer end of the east jetty, which was damaged by being struck by the steamer *M. A. Hanna*, has been completely repaired, though the repair work involved the loss of about 18 feet of the structure, which was too badly shattered to be rebuilt. The cost of the repair work was $1,843.67. A suit is now pending for the recovery of damages from the owner of the vessel.

In the spring of 1904 examinations showed that the customary shoaling and bar formation had occurred. A narrow channel existed, but it was crooked and difficult to follow, and a great deal of material had accumulated at the sides of this channel, both between the jetties and outward on the bar. Proposals were opened on February 29 for dredging at this harbor. The award was made to the lowest bidder, but he failed to complete his contract by filing a proper bond, claiming that the bid had been made in his name by an unauthorized agent. The contract was finally annulled and the work readvertised, the second set of bids being opened May 28, 1904. The contract was awarded to the Detroit Dredging Company. They sent a machine quite promptly to the place and the work was in progress at the close of the fiscal year.

* * * * * * *

For a detailed description of the work done, and tabulated statements of materials and cost, attention is respectfully invited to the report of Assistant Engineer Howard E. Smith, which is transmitted herewith.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $438,174.99 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $34,003.56 | |
| For maintenance of improvement | 3,426.99 | |
| Allotment for new dredge | 20,000.00 | |
| | | 57,430.55 |
| July 1, 1904, balance unexpended | | 380,744.44 |
| July 1, 1904, outstanding liabilities | | 5,205.61 |
| July 1, 1904, balance available | | 375,538.83 |
| July 1, 1904, amount covered by uncompleted contracts | | 167,243.10 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | | 10,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

June 15, 1904, witnessed a resumption of work on the west breakwater. The plant on hand, consisting of a derrick scow and a small deck scow, is not sufficient to meet their needs, and the work must proceed slowly until there be an increase to their plant. The work is restricted to the 300 feet of breakwater immediately outside of the timber breakwater, and small stone is being placed approximately to water surface, and the outer slope is being prepared for the paving stone. You have notified me of a change in the paving slopes of the breakwaters, approved by the Chief of Engineers April 28, 1904, involving no material change in the amount of material that will be required in the breakwaters. In accordance with the change, the outer slope will be 1 on 2 (instead of 1 on 2½) and the inner slope will be 1 on $1\frac{3}{10}$ (instead of 1 on ¾). This change will facilitate construction of the inner slope and make it more stable against the action of waves and ice.

The progress on the pierheads and breakwaters is denoted by the following tables:

FOR FISCAL YEAR ENDING JUNE 30, 1904.

| Items. | Quantity. | Unit price. | Value at contract price. |
|---|---|---|---|
| *Pierhead.* | | | |
| Filling stone ........ tons.. | 400 | $1.20 | $480.00 |
| Screw bolts and washers ........ pounds.. | 1,200 | .04 | 48.00 |
| Wrought-iron pipe ........ do.... | 331 | .10 | 33.10 |
| Oak timber ........ feet B. M.. | 2,111 | .046 | 97.11 |
| *West breakwater.* | | | |
| Heavy riprap ........ tons.. | 667 | 1.43 | 958.81 |
| Core filling ........ do.... | 943 | .77 | 726.11 |
| Small stone ........ do.... | 5,006½ | 1.16 | 5,807.54 |
| Paving stone ........ do.... | 138 | 2.09 | 288.42 |
| *East breakwater.* | | | |
| Heavy riprap ........ tons.. | 3,375 | 1.43 | 4,826.25 |
| Core filling ........ do.... | 960 | .77 | 739.20 |
| Small stone ........ do.... | 2,050 | 1.16 | 2,378.00 |
| Total ........ | ........ | ........ | 16,377.54 |

GENERAL PROGRESS.

| Items. | Total to June 30, 1904. | | Total required. | | Per cent completed. |
|---|---|---|---|---|---|
| | Quantity. | Prices. | Quantity. | Prices. | |
| *Pierheads.* | | | | | |
| Foundation stone ........ tons.. | 6,737 | $8,488.62 | 6,737 | $8,488.62 | 100.0 |
| Concrete blocks ........ cubic feet.. | 9,650 | 3,956.50 | 9,650 | 3,956.50 | 100.0 |
| Mass concrete ........ cubic yards.. | 740 | 6,216.00 | 740 | 6,216.00 | 100.0 |
| Filling in superstructure ........ tons.. | 591 | 709.20 | 790 | 948.00 | 74.8 |
| Oak fenders ........ feet B. M.. | 2,111 | 97.11 | 2,100 | 96.60 | 100.0 |
| Bolts, washers, and collars ........ pounds.. | 1,200 | 48.00 | 900 | 36.00 | 100.0 |
| Wrought-iron pipe ........ do.... | 331 | 33.10 | 225 | 22.50 | 100.0 |
| Paving stone ........ tons.. | 0 | 0 | 82 | 196.80 | 0 |
| Crib structures ........ | ........ | 16,356.04 | ........ | 16,356.04 | 100.0 |
| *West breakwater.* | | | | | |
| Heavy riprap ........ tons.. | 34,684¼ | 49,598.49 | 37,000 | 52,910.00 | 93.7 |
| Core filling ........ do.... | 66,714½ | 51,370.17 | 70,000 | 53,900.00 | 95.3 |
| Small stone ........ do.... | 38,117½ | 44,216.30 | 59,000 | 68,440.00 | 64.6 |
| Paving stone ........ do.... | 138 | 288.42 | 18,000 | 37,620.00 | .7 |
| *East breakwater.* | | | | | |
| Heavy riprap ........ tons.. | 16,306½ | 23,318.29 | 22,500 | 32,175.00 | 72.5 |
| Core filling ........ do.... | 40,512 | 31,194.24 | 45,000 | 34,650.00 | 90.0 |
| Small stone ........ do.... | 18,077 | 20,969.32 | 49,000 | 56,840.00 | 36.9 |
| Paving stone ........ do.... | 0 | 0 | 15,500 | 32,395.00 | 0 |
| Total ........ | ........ | 256,859.60 | ........ | 405,247.06 | 63.3 |

*Surveys and restoration by dredging of channel.*—Between November 12 and December 3, 1903, a survey was made of the jettied channel as far as the swing bridge and outside of jetties on their line of prolongation to the deep water of lake. There was a slight evidence of bar formation from the westward about 300 feet outside the end of the west jetty. On the east side there had been a general movement of sand for a distance of 700 feet from the end of the east jetty toward the center of channel. There was a clear 20½-foot channel of at least 80 feet width between the ends of jetties and deep water of lake.

A survey was again made on April 5 and 6, 1904. By this time the bar had formed across the channel about 400 feet outside the west jetty, over which there was a depth of 19 feet in mid-channel and less on either side. As regards navigation, the worst condition obtained in the jettied channel, where it was very narrow for about 600 feet in length.

A circular letter was issued by you on January 29, 1904, inviting proposals for dredging at Ashtabula Harbor, to be opened February 29, 1904. The lowest bidder was the Charles S. Boone Company, and an agreement was entered into for doing the dredging, which was duly signed. The contract was, however, forfeited by the failure of the contracting party to execute a bond, and you again advertised for bids on May 17, 1904, to be opened May 28, 1904. The lowest bidder was the Detroit Dredging Company, to whom the contract was awarded. The price for the dredging was $0.30 per cubic yard, and board of inspector and assistant, $0.60 per day for each. The work was started June 2, and is not completed at close of year. Twenty-two thousand four hundred and eighty cubic yards of material have been removed, and its value, at the contract price, including the board of one inspector for thirteen days, is $6,751.80.

*Repairs of existing structures.*—As stated in my last annual report, the outer end of the east jetty was injured November 22, 1902, by the collision of the steamer *M. A. Hanna.* May 27, 1903, you advertised for bids for labor and material required in the repair of jetty. The work was awarded to J. G. Laird & Sons, of Ashtabula. The repair was started July 1, 1903, and was completed October 22, 1903, with frequent interruptions, due to unfavorable weather. The jetty was cut off on a line 18 feet from the outer end, and the wreckage, consisting of timber, iron fastenings, and stone, was removed with a dredge. The outer end and 10 linear feet of the side walls were then covered with 3-inch oak sheathing, and finally, four tie-rods were inserted to hold the side walls securely together.

The cost was as follows:—

*Labor and appliances.*

| | |
|---|---|
| 38¼ days, foreman, at $3.25 per day | $124.31 |
| 31½ days, diver and 3 assistants, at $20 per day | 630.00 |
| 31½ days, use of diving apparatus, at $10 per day | 315.00 |
| 48⅛ days, carpenters, at $3.25 per day | 156.41 |
| 22½ days, laborers, at $2 per day | 45.00 |
| 16 hours, use of dredge with crew, at $18 per hour | 288.00 |
| 28⅝ days, use of derrick, at $3 per day | 85.88 |
| | 1,644.60 |

*Material.*

| | |
|---|---|
| 1,870 feet B. M., oak timber, at $0.05 per foot B. M | $93.50 |
| 202 feet B. M., pine timber, at $0.03 per foot B. M | 6.06 |
| 533½ pounds lag screws and washers, at $0.05 per pound | 26.68 |
| 502¾ pounds tie-rods and washers, at $0.05 per pound | 25.13 |
| 920 pounds corner plates, at $0.05 per pound | 46.00 |
| 34 pounds driftbolts, at $0.05 per pound | 1.70 |
| | 199.07 |
| Total | 1,843.67 |

*Widening of river channel by Pennsylvania Company.*—As may be noted in my last annual report, the Pennsylvania Company, under authority of the Secretary of War, on January 31, 1903, began certain improvement on the westerly side of the Ashtabula River. Approximately 1,000 feet of old Government pier and revetment were removed and a new dock of stone-filled timber cribs was built on a line 60 feet back from the line of the old work. The new dock, which is now completed, is 1,036 feet long on the straight portion, and is connected with the old pier by cribwork placed obliquely, 61.6 feet long on its face. Connection is made with the old pier at a point 1,130 feet from the outer end. The dredging within the area between the lines of the old pier and the new dock is fast nearing completion. The new dock is connected with Haskell dock by a sheet pile revetment of light construction.

*Construction of Government storehouse.*—An allotment of $500 was obtained in March, 1903, for constructing a storehouse in which to shelter the boats and store other property of the United States. The buildings hitherto used for this purpose had been removed by the Pennsylvania Company, and they were not of sufficient value to warrant their preservation and removal elsewhere. Considerable time was consumed in getting a suitable site for the storehouse, but at length a site was obtained on land leased from the Lake Shore and Michigan Southern Railway Company. Work of construction was started July 6, and was completed August 7, 1903. The building is of wood, one story high, and 18 feet by 30 feet in plan. A timber incline leads from the storehouse to the river, so that boats are readily transferred from one to the other. A statement of cost of building the storehouse is as follows:

| | |
|---|---|
| Lumber | $265.77 |
| Hardware | 43.99 |
| Labor | 151.72 |
| Tar and gravel roof | 38.50 |
| Total | 499.98 |

Very respectfully,

Howard E. Smith,
*Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

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## P P 10.

## IMPROVEMENT OF CONNEAUT HARBOR, OHIO.

The project for the improvement of this harbor was adopted in 1896, and is given in full on pages 2970 and 2971, Report of the Chief of Engineers for that year.

* * * * * * *

But little work was done during the summer of 1903. The contractor was directing his efforts toward the completion of work at Fairport, but in the fall the construction of cribs for Conneaut was commenced and was carried on rapidly. Eight cribs were built, of an aggregate length of 1,377 feet. They contained 1,589,000 feet B. M. of timber. Most of the cribs were intended for the renewal of the shoreward end of the jetties. They had to be sunk in trenches dredged to a depth of not less than 21 feet below mean lake level, and as the water was shallow where they were placed these trenches were necessarily very deep. But little trouble was experienced on the eastern side, but on the west side, where the exposure was greatest, the waves continually washed the beach material into the cut and across it into the channel. The work was so greatly delayed that I was forced to authorize the construction of a temporary spur of large riprap to the westward of the cut to break the force of the waves. Eight hundred tons of large stone was used for this purpose. This afforded sufficient protection to enable the trench to be completed and the cribs sunk. The last crib was not in place until the 20th of December. The material washed into the channel was moved by the current and some of it carried outward upon the bar. This resulted in the shoaling both on the bar and between the jetties, which greatly interfered with navigation, and for a short time stopped it entirely for the larger class of ships. The dredging plant of the contractor was utilized to restore the channel.

Work was resumed in the spring of 1904, and another crib 163 feet in length has been built and sunk at the outer end of the west jetty. This completed all of this class of work proposed for the jetties. In addition, 745 linear feet of concrete superstructure has been completed. Some work has been done in preparation of the foundations for the east and west breakwaters. Two cribs have been completed for the east breakwater, and two more are under construction. In all, about 40 per cent of the proposed work has been completed.

In the original contract it was proposed to construct the east breakwater as a rubble mound, but during the winter the contractor submitted a proposition for building it of timber cribs with a concrete superstructure. He made considerable reduction in the unit prices of material, and promised in addition to complete the entire work one year earlier than his contract required. The advantages of the proposed change to the United States were that it would secure uniformity of construction in all of the works at the harbor; that it would effect a saving of about $1,000 in the actual cost of the breakwater and about $3,000 in the cost of inspection on account of difference in the style of work, and about $10,000 more on account of the reduction in the time of completion of the whole work. For this reason the proposition was accepted and a supplementary agreement was entered into and approved to give it effect. It will require about $50,000 to complete the east breakwater, and hence the present project for the improvement of the harbor. An appropriation of this amount is recommended.

The outer end of the west jetty had been damaged in 1902 by being struck by the steamer *Mecosta*. It was temporarily repaired so as to hold it together, but it was necessary to completely repair it before the new crib was sunk in extension of the jetty. The work of repair, while not great in itself, required the use of a very extensive plant. A dredge was necessary; also a steam derrick boat and a full diving outfit. It was evident that these things could not be brought from a distance without great cost, and the only available machinery of the kind belonged to the contractor. An informal agreement was therefore entered into with The Donnelly Contracting Company for making the repair upon the basis of labor account and an agreed price for the use of plant, and work was done at a cost of $1,345.84. It involved the cutting away and removal of 9 linear feet of the jetty. A suit for damages is now pending against the owners of the vessel.

Surveys during the winter indicated that the bar had re-formed beyond the jetties, and proposals were invited and a contract entered into for its removal. The dredging between the jetties was a part of the original contract, and the contractor was required to do this work. It proved to be very much greater than was originally estimated. Emergency work on the bar cost 32 cents a yard and required the removal of 9,956 cubic yards of material.

For a detailed account of the operations at this harbor attention is respectfully invited to the report of Asst. Engineer Howard E. Smith, which is transmitted herewith.

## *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $204, 341. 21 |
| Amount appropriated by sundry civil act approved April 28, 1904 | | 240, 000. 00 |
| | | 444, 341. 21 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $128, 076. 56 | |
| For maintenance of improvement | 10, 000. 00 | |
| Allotment for new dredge | 10, 000. 00 | |
| | | 148, 076. 56 |
| July 1, 1904, balance unexpended | | 296, 264. 65 |
| July 1, 1904, outstanding liabilities | | 19, 584. 55 |
| July 1, 1904, balance available | | 276, 680. 10 |
| July 1, 1904, amount covered by uncompleted contracts | | 317, 692. 79 |
| Amount (estimated) required for completion of existing project | | 50, 000. 00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $50, 000. 00 | |
| For maintenance of improvement | 10, 000. 00 | |
| | | 60, 000. 00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

### AMOUNT AND DATE OF ALL APPROPRIATIONS.

| | | |
|---|---|---|
| March 3, 1829 | | $7, 500. 00 |
| April 23, 1830 | | 6, 135. 65 |
| March 2, 1831 | | 6, 370. 00 |
| July 2, 1832 | | 7, 800. 00 |
| July 2, 1836 | | 2, 500. 00 |
| March 3, 1837 | | 5, 000. 00 |
| July 7, 1838 | | 8, 000. 00 |
| June 11, 1844 | | 5, 000. 00 |
| August 30, 1852 | | 10, 000. 00 |
| June 23, 1866 | | 20, 513. 74 |
| March 2, 1867 | | 10, 000. 00 |
| April 10, 1869 (allotment) | | 8, 910. 00 |
| June 11, 1870 | | 6, 000. 00 |
| March 3, 1873 | | 400. 00 |
| June 23, 1874 | | 1, 500. 00 |
| March 3, 1875 | | 1, 000. 00 |
| June 14, 1880 | | 6, 000. 00 |
| July 13, 1892 | | 40, 000. 00 |
| August 18, 1894 | | $40, 000. 00 |
| June 3, 1896 | | 40, 000. 00 |
| March 3, 1899 | | 100, 000. 00 |
| July 2, 1900 (allotment) | | 3, 000. 00 |
| March 30, 1901: | | |
| Allotment | $2, 500. 00 | |
| Redeposited April 19, 1902 | 431. 80 | |
| | | 2, 068. 20 |
| June 13, 1902 | | 200, 000. 00 |
| March 3, 1903 | | 10, 000. 00 |
| April 28, 1904 | | 240, 000. 00 |
| Total | | 787, 697. 59 |
| Expended to June 30, 1904 | | 491, 432. 94 |
| Unexpended July 1, 1904 | | 296, 264. 65 |

### LIST OF CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1904.

*Contract for construction of breakwaters, the extension of and the reconstruction of east and west piers.*

Name of contractor: The Donnelly Contracting Company, Buffalo, N. Y.
Date of contract: November 14, 1902.
Date of approval: December 22, 1902.
Date of commencement: April 14, 1903.
Date of completion: Continuous contract.

### COMMERCIAL STATISTICS.

The following statistics for the year 1903, relative to the commerce of the harbor of Conneaut, Ohio, were compiled from information furnished by the collector of customs and others:

| Receipts. | Tons. | Shipments. | Tons. |
|---|---|---|---|
| Iron ore | 4,372,409 | Coal | 786,834 |
| Stone | 18,205 | Coke | 792 |
| Railroad ties | 9,776 | Iron and steel | 95,708 |
| Lumber, etc | 8,969 | Miscellaneous | 1,551 |
| Miscellaneous | 2,747 | | |
| Total | 4,412,106 | Total | 884,885 |

Total freight tonnage:

| | |
|---|---|
| 1903 | 5,296,991 |
| 1902 | 5,286,611 |
| Increase | 10,380 |

| Vessels. | Number. | Tonnage. |
|---|---|---|
| Entering | 1,445 | 3,096,877 |
| Departing | 1,445 | 3,096,877 |

Total registered tonnage:

| | |
|---|---|
| 1903 | 6,193,754 |
| 1902 | 5,991,550 |
| Increase | 202,204 |

Draft of largest vessels using harbor, 20 feet.
Largest vessels do not load to full depth.
No new vessel lines established during the year.

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### REPORT OF MR. HOWARD E. SMITH, ASSISTANT ENGINEER.

ASHTABULA, OHIO, *June 30, 1904.*

MAJOR: I have the honor to submit the following report of operations at Conneaut Harbor, Ohio, for the fiscal year ending June 30, 1904:

A contract is in force with The Donnelly Contracting Company for constructing parts of the east and west breakwaters and for extending and reconstructing parts of east and west piers. The original contract is dated November 14, 1902, and supplemental agreements are dated December 14, 1903, and February 6, 1904.

Work under this contract was begun April 14, 1903, on the foundation for the west breakwater extension, followed by work on foundation for west pierhead. The foundations were not completed when the contractors temporarily stopped work May 4, 1903, and withdrew most of their plant to work at other harbors.

During the preceding winter, the contractors had installed at Fairport a very complete plant for building timber cribs. It consists of a planer for sizing timbers, air compressor with connections for boring machines, and derricks for handling and placing the sticks. The facilities are such that 2 or 3 cribs may be under construction at the same time. This plant was employed for building cribs at Fairport in the early part of 1903, and a start was made on cribs for Conneaut July 11, 1903. The plant continued in operation until November 25, 1903, having turned out 8 cribs

18 feet wide, whose aggregate length was 1,377 feet. One million five hundred and eighty-nine thousand feet B. M. of timber were used and the average daily placement of timber in the cribs amounted to nearly 12,000 feet B. M. After remaining closed during the winter, the crib-building plant was again set in operation on April 30, 1904. Up to the close of the fiscal year one crib, 163 feet long and 24 feet wide, has been built for the outer extension of the west pier, and one crib with bevel end, extreme length 174 feet and width 24 feet, has been built for the east breakwater. Two cribs, also for the east breakwater, are in process of construction.

August 18, 1903, the contractors again resumed work at Conneaut. They began to tear out the old stone-filled timber cribs at the inner end of the west pier, a dredge of moderate capacity being employed for this purpose. Following the removal of a portion of the old crib work, a trench with bottom 21 feet below lake level, 30 feet wide and about 200 feet long, was excavated and a small riprap stone foundation was placed in the trench, on which the crib was to rest. Crib No. 1, 192 feet long, was sunk in this trench on September 14.

The work of removing the old crib work continued inward toward shore, but on account of the strong westerly winds and consequent heavy seas that prevailed throughout the autumn months, the dredge was unable to make good progress, and so a second dredge was brought to the harbor and set to work October 7. Even then progress was slow. Sand was carried through the gap into the navigable channel to such an extent that the larger vessels grounded frequently, and finally it became necessary to dredge in the channel of navigation abreast of the breach in the west pier in order to allow the passage of vessels.

As the season was now well advanced, it was apparent that it would be necessary to place some kind of protection outside the gap in the west pier, to check the movement of sand through the gap into the channel. October 29 you authorized the placing of 800 tons of heavy riprap west of the west pier, on a line extending from shore far enough out to prevent the waves and sand from entering the gap. Thereafter no further difficulty was experienced. The trench was excavated, the foundation of small riprap stone was placed, and after remaining open for two and one-half months the gap in the west pier was finally closed. One crib 134 feet long was sunk December 1, and one crib 192 feet long was sunk December 3, thereby completing the substructure for the inner portion of the west pier.

The work at the inner end of the east pier consisted of the removal of 412 linear feet of old pile revetment, the excavation of a trench of the same length, and the construction of a foundation of small riprap stone about 1 foot thick upon which to place the new cribs. The dredging was started here on October 1 and was continued without interruption until a trench was entirely excavated for the cribs. One crib 192 feet long was sunk November 2, and the second one, 215 feet long, was sunk November 6.

Dredging for the outer extension of the east pier was begun on November 8 and the cribs were sunk as follows: The first, 192 feet long, on November 20; the second, 68 feet long, on November 29; the third, 192 feet long, on December 18. The third crib was filled with stone December 20, and on December 21 the contractors suspended operations and laid up their plant for the winter. On April 8, 1904, the contractors resumed operations at Conneaut. A dredge was set to work removing material in channel between piers to a depth of 21 feet. About 23,000 cubic yards were removed.

The original contract provided that the east breakwater should be constructed entirely of stone, following the design of the rubble mound breakwater. A supplementary agreement was made February 6, 1904, authorizing a change in the east breakwater to stone-filled timber cribs and concrete superstructure. In consideration of the change, the date named in contract for completion was changed from November 15, 1906, to November 15, 1905. Work on east breakwater was begun May 4, and has continued without interruption except that due to weather. The foundation, composed of heavy riprap and small riprap stone for the full length of 750 feet, has been placed.

May 5, 1904, the contractors began to set concrete blocks on the timber crib substructures that were placed during the preceding season, and the building of mass concrete closely followed. At first the contractors were not able to secure the necessary space in which to manufacture blocks, so the first 128 blocks were built at Fairport and conveyed by vessel to Conneaut. At present the blocks are manufactured at Conneaut. The mass concrete was built, generally, in sections 32 feet long, containing 100.3 cubic yards of concrete. Seven hundred and forty-five linear feet of concrete superstructure have been completed up to the close of the fiscal year.

The outer end of the west pier was injured by collision of the steamer *Mecosta* on

July 21, 1902, as noted in my last annual report. Before extending the west pier outward, as provided for in the existing contract, it was necessary to repair the injury. An informal agreement was entered into with the Donnelly Contracting Company for making the repair. Work was begun May 14 and was completed June 12, 1904. A statement of cost is as follows:

| | | |
|---|---|---|
| 23¾ hours' use of dredge with crew, at $20 per hour | | $475.00 |
| 51 hours' use of derrick with crew, at $6 per hour | | 306.00 |
| 15 days' time of diver with apparatus and one tender, at $30 per day | | 450.00 |
| 339½ hours' time of laborers, at $0.20 per hour | $67.90 | |
| 6 hours' time of carpenters, at $0.30 per hour | 1.80 | |
| 650 pounds iron, at $0.04 per pound | 26.00 | |
| | | 95.70 |
| Plus 20 per cent | | 19.14 |
| Total cost | | 1,345.84 |

The end was cut off 1½ feet forward of the second cross wall from the end, and four iron tie-rods were inserted to hold the side walls together. The repair involved the removal of 9 linear feet of pier. Before the final completion of the repair work a crib, 163 feet long and 24 feet wide, was sunk at the end of the west pier on June 5.

*Surveys of, and dredging of, channel.*—Soundings were taken in channel between December 21, 1903, and January 4, 1904. A bar was in process of formation across the channel, outside of piers, and the channel of 20-foot depth was about 40 feet wide. Between piers the condition was even more unfavorable to navigation, and vessels drawing 17 feet could scarcely find water enough. This condition was due to the fact that the water surface of the lake was low, and that much sand had settled in the channel after being carried through the gap which existed in the west pier as a result of the contractor's operations at about that time. A survey of the channel, made April 6 and 7, showed a condition in channel much improved on the whole. The deeper channel is supposed to be due to the action of the ice which was brought down the river in freshet, and scoured out the channel ahead of it. March 3, 1904, a contract was entered into with James B. Donnelly for dredging through the bar at entrance at a price of $0.32 per cubic yard. Work was begun April 7, and was completed May 13. Nine thousand nine hundred and fifty-six cubic yards of material were removed at a total cost, including board of inspectors, of $3,197.17.

*Removal of rear range tower.*—The rear range tower, being located upon the site of a part of the new west pier, its removal was necessary. The work of removal was undertaken by the Donnelly Contracting Company on daily force account. The tower was moved 111 feet 9 inches south of its former location, maintaining the same range with the light-house at outer end of west pier. The work was done in September, 1903, and the cost to the United States was $175.20.

The quantity and value of labor and material furnished are as follows:

DURING FISCAL YEAR ENDING JUNE 30, 1904.

| Items. | Quantity. | Unit price. | Value at contract price. |
|---|---|---|---|
| *Timber crib and concrete piers.* | | | |
| Concrete blocks ........ cubic yards.. | 1,091.6 | $10.00 | $10,916.00 |
| Concrete in mass ........ do.... | 2,414.6 | 7.40 | 17,868.04 |
| Small riprap stone ........ tons.. | 19,360.5 | 1.33 | 25,749.47 |
| Dredging ........ cubic yards.. | 66,020.0 | .29 | 19,145.80 |
| Removing rock and shale ........ do.... | 280.0 | 1.55 | 434.00 |
| Heavy riprap ........ tons.. | 1,141.0 | 1.65 | 1,882.65 |
| Removing old pier ........ linear feet.. | 518.0 | 5.00 | 2,590.00 |
| Removing old pile revetment ........ do.... | 412.0 | 6.00 | 2,472.00 |
| Crib structures (exclusive of stone filling) ........ | ........ | ........ | 74,550.52 |
| *Timber crib and concrete breakwater.* | | | |
| Heavy riprap stone ........ tons.. | 1,840.0 | 1.60 | 2,944.00 |
| Small riprap stone ........ do.... | 3,460.0 | 1.30 | 4,498.00 |
| *Two pier heads.* | | | |
| Heavy riprap stone ........ tons.. | 250.0 | 1.65 | 412.50 |
| Small riprap stone ........ do.... | 90.0 | 1.33 | 119.70 |

DURING FISCAL YEAR ENDING JUNE 30, 1903.

| Items. | Quantity. | Unit price. | Value at contract price. |
|---|---|---|---|
| *Timber crib breakwater.* | | | |
| Heavy riprap stone ........tons.. | 528.0 | $1.65 | $871.20 |
| Small riprap stone........do.... | 1,244.0 | 1.35 | 1,679.40 |
| *Two pier heads.* | | | |
| Heavy riprap stone ........tons.. | 357.5 | 1.65 | 589.88 |
| Small riprap stone........do.... | 204.0 | 1.33 | 271.32 |
| Cutting off end of west pier........ | | | 1,345.84 |
| Moving rear range tower........ | | | 175.20 |
| Total value of work done to June 30, 1904........ | | | 168,515.52 |

*Repair of west breakwater.*—On May 30, 1903, the west breakwater was injured by collision of the steamer *George Stephenson*, owned by the Pittsburg Steamship Company. Recognizing its liability, the company caused the breakwater to be repaired in August, 1903, without expense to the United States.

*Wrecks.*—The steam car ferry, *Shenango No. 1*, operated by the Marquette and Bessemer Dock and Navigation Company between Conneaut and Canadian ports, was burned to the water's edge while icebound off Conneaut Harbor on the morning of March 11, 1904. The next day the vessel sank to bottom in about 25 feet of water. The vessel lies about 1,000 feet outside the piers, just westward of the channel of navigation, and a spar buoy marks the easterly limit of the wreck. The wreck was abandoned in turn by the owners and the underwriters, and the responsibility for its removal fell upon the United States. The matter was duly advertised by you, and among others a bid for its removal was received from George W. Pfohl, who proposed to remove the wreck without expense to the United States. The contract was awarded to Mr. Pfohl under date of May 26, 1904, and he is at present engaged in removing the obstruction.

The work at Conneaut Harbor is under the local supervision of Mr. Wilson T. Howe, junior engineer.

Very respectfully,

Howard E. Smith,
*Assistant Engineer.*

Maj. Dan C. Kingman,
*Corps of Engineers.*

## P P II.

## REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

*Tow barge L. L. Lamb.*—On the night of August 16, 1902, the tow barge *L. L. Lamb* foundered and sank about a mile northwest of the Fairport Harbor light. This vessel was originally a schooner of 253 tons gross and was built in 1869. It had been remodeled into a tow barge. At the time it was wrecked it was loaded with 410 tons of large riprap stone intended for use in improving the harbor at Ashtabula, Ohio. About one-fourth of this load was in the hold of the vessel and the remainder on deck. It sunk in attempting to make the harbor of Fairport for refuge in time of a very severe storm.

An allotment of $1,500 was made for the removal of this wreck, but advertisements failed to produce any proposals. The wreck was marked with a buoy, which was repeatedly carried away. Examinations showed that it was rapidly breaking up. In the spring of 1904 the U. S. dredge *Maumee*, which was employed in improving the harbor at Fairport, was sent to the wreck and worked over it, pushing about and scattering the stone which formed the deck load. The vessel seemed to have been almost entirely broken up. The work of the dredge was such as to leave a clear depth of not less than 23 feet of water over the entire wreck, and it is now no longer an obstruction.

The exact cost of this work had not been determined and paid at the end of the fiscal year, but the allotment that was made will be more than sufficient to cover it.

*Steamer Lockwood.*—The steamer *Lockwood*, a vessel of 2,323 tons burden, was lost in Lake Erie in October, 1902. The location of the wreck was unknown for some time. Report was finally made that it had been seen, and an allotment of $500 was made for its examination. The United States Survey boat was sent to find it, and it was located at a point north-northwest 13½ miles from Fairport light, and northeast by north three-eighths north, 34¼ miles from the Cleveland breakwater light. It lies in a depth of 75 feet of water. Nothing showed except a piece of floating rigging apparently attached to the hull. There was 55 feet of water over the wreck, but a broken mast came within 7 feet of the water surface. A buoy was prepared and sunk at the wreck. The wreck was visited again on the 12th of October, 1903. The buoy was found still in position, but the wreckage was gone, and by carefully sweeping over the hull it was determined that the broken mast was gone also. The wreck appeared to be broken and the bottom was covered with some kind of small grain. Depths over the wreck were from 47 to 60 feet. It is therefore no longer an obstruction to navigation.

The total amount expended in connection with this work was $353.37, and the balance of the allotment has been returned to the Treasury.

*Steamer Chas. H. Davis.*—On June 13, 1903, the steamer *Chas. H. Davis*, loaded with 550 tons of limestone, en route from Kelleys Island to Cleveland, Ohio, foundered and sank in 38 feet of water about 3,500 feet northwest of the light on the end of the west breakwater at the main entrance to the harbor of Cleveland. A severe northwest gale was blowing at the time and the vessel in turning to enter the harbor got into the trough of the sea, her cargo shifted, and she sank in a few minutes. The master of the vessel was drowned, but the remainder of the crew were saved. A search was made as soon as possible for the wreck, which was located, and a buoy was at once placed to mark it. As soon as practicable the wreck was examined by a diver and it was found that there was a full depth of not less than 32 feet of water everywhere over it. It was not, therefore, an obstruction to navigation.

The cost of preparing and placing the buoy was $25, and an allotment was made August 5, 1903, to cover this expense.

*Wrecked crib near Fairport, Ohio.*—A piece of wreckage, apparently a portion of an old timber crib, was reported as floating in the lake off Fairport Harbor. Accordingly a tug was hired and sent out to find it and bring it ashore. This was done on the 29th of July, 1903. The wreckage was found to consist of what appeared to be the side wall of a timber crib built of 12 by 12 sticks. It was about 12 feet wide and 25 feet long, and was capable of severely injuring any vessel that might strike it.

The cost of finding and destroying this piece of wreckage was $25, and an allotment to cover it was made August 7, 1903.

*Steamer Queen of the West.*—On the morning of August 20, 1903, the steamer *Queen of the West*, of Cleveland, Ohio, sank in Lake Erie in 12 fathoms of water about 9 miles north-northeast of Fairport light. The vessel was of 876 gross tonnage, and was said to have been bound for the port of Erie, Pa., with a cargo of iron ore. The master and crew of the vessel came ashore in their small boats. The wreck was visited and examined by the U. S. tug *Quest*. It was found to be in about 72 feet of water. The foremast and the upper works had floated out of the vessel, but the mainmast was still standing, and formed a dangerous obstruction to navigation. The wreck was marked temporarily by a spar buoy. The owners were communicated with and stated that they had abandoned the wreck. Accordingly, on the 24th of August, the tug *Quest* was again sent to the wreck and removed the mainmast and all other wreckage which would interfere with navigation.

The cost of all the work done in connection with this wreck was $98.07, and an allotment was made on August 28 of this sum to cover it.

*Schooner General Franz Sigel.*—This vessel was wrecked about the 18th of July, 1903, and is now lying in Lake Erie near Stony Point. The vessel was listed as follows:

"Schooner *General Franz Sigel*, three masts; gross tonnage, 316; length, 136.8 feet; breadth, 25.8 feet; depth, 11.5 feet; built in 1862, Black River, Ohio."

The owner, who was also the master, reported that he would make no attempt to save anything but the canvas. The wreck was visited on the United States Survey boat, and its exact location fixed by ranges and angles. An allotment of $2,500 was made October 6, 1903, for its removal.

It was proposed to remove this wreck by the use of the United States dredging plant, but the lateness of the season rendered it impracticable to do it before winter. The wreck was visited in the spring of 1904 and found without difficulty from the ranges, but the masts had been carried away. The work of removal will be carried out during the month of July, 1904. The amount expended in visiting and examining the wreck was $46.

*Yacht Idler.*—On the 23d day of March, 1904, the yacht *Idler* sank off the entrance to Fairport Harbor, Ohio, about 300 feet beyond the end of the jetties. It was left in a position to interfere with and endanger navigation. The yacht was 97 feet long, 23 feet beam, and 9.7 feet deep. It was carried out of the harbor by freshets and ice about the middle of the winter, but it did not actually sink until the date above given. The reputed owner was communicated with to learn his intention concerning the wreck. He replied that he had sold it, and gave the address of the purchaser. After much difficulty the purchaser was found, and he finally admitted that he had also abandoned the wreck. The U. S. dredge *Maumee* was employed to remove it. It was stated that the yacht had been heavily ballasted with pig iron and it was hoped that enough of this would be saved to defray the cost of its removal, but in point of fact no pig iron was obtained. The wreck was entirely broken up and taken away. If there was any iron in the hold it settled down so deep in the sand that the dredge could not reach it.

The actual cost of removing this wreck was $375, and an allotment has been asked for to cover the expense.

*Car ferry Shenango No. 1.*—On the 29th day of March, 1904, the steam car ferry *Shenango No. 1*, operated by the Marquette and Bessemer Dock and Navigation Company, was destroyed by fire while it was held bound in the ice outside the harbor of Conneaut, Ohio. It burned to the water's edge, and after floating about twenty-four hours it sank to the bottom. It contained 26 empty steel gondola cars. The wreck lay in about 24 feet of water at the stern and 18 feet at the bow. It was nearly on a straight line drawn from the outer end of the unfinished west breakwater to the outer end of the west jetty. Some portions of the wreck showed above the water. The owners were communicated with and finally declared their intention of abandoning the wreck.

The estimated cost of its removal was $2,500, and an allotment was made April 21, 1904, to cover this expense.

Proposals were invited by advertising for thirty days, and the lowest bid received was that of George W. Pfohl, of Buffalo, N. Y., who undertook to remove the wreck for the salvage without cost to the United States. The work of removal is now in progress. The amount expended from the allotment for advertising, etc., was $15.16. It has not been considered necessary to keep an inspector on the work, as it is under the general observation of the inspectors employed in improving the harbor of Conneaut. It will be necessary to examine the site after the wreck is removed.

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## P P 12.

## PRELIMINARY EXAMINATION AND SURVEY OF HURON HARBOR, OHIO.

[Printed in House Doc. No. 122, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: Under the provisions of the river and harbor act approved June 13, 1902, a preliminary examination and survey have been made of Huron Harbor, Ohio, "with a view to securing a channel with a depth of 20 feet," and I have now the honor to submit herewith for transmission to Congress reports on the subject, dated February 12, 1903, and August 1, 1903, respectively, by the local engineer, Maj. Dan C. Kingman, Corps of Engineers, together with indorsements thereon by the division engineer, Col. O. H. Ernst, Corps of Engineers, and the Board of Engineers for Rivers and Harbors, to which the papers were referred for consideration as provided for in sections 3 and 14 of said act.

Huron Harbor has been under improvement by the United States with a view to securing a navigable depth of 16 feet, and the plan of further improvement recommended by the district officer provides for the repair and extension of the present west jetty, the construction of a new east jetty, and dredging in the channel to secure a navigable depth of 20 feet, all at an estimated first cost of $315,500, and an annual expenditure of $2,500 for maintenance. In the opinion of the Board the commerce involved is of such extent and character as to render the locality worthy of further improvement as recommended by the district officer. In this opinion I concur.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF HURON HARBOR, OHIO.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cleveland, Ohio, February 12, 1903.*

GENERAL: In compliance with instructions contained in Department letter of June 23, 1902, I have personally visited the harbor of Huron, Ohio, and have examined it with a view to securing a channel with a depth of 20 feet, and I have the honor to submit the following report:

Huron Harbor, Ohio, is situated within the mouth of the Huron River. In its natural condition the mouth of the river was practically closed by a sand bar.

The first project for its improvement was adopted in 1826, and this provided for the construction of two parallel jetties 140 feet apart extending outward from the river banks. The jetties were lengthened from time to time and were repaired as required, and the channel was finally deepened by dredging. In 1890 the project was modified to provide for the extension of the jetties out to a depth of 16 feet of water in the lake and for obtaining a like depth between the jetties by dredging.

The first appropriation was made in 1826, and the total amount appropriated up to the present time is $237,723.71. The last appropriation was $40,000, and this amount has not all been expended.

This harbor forms the lake terminus of the Wheeling and Lake Erie Railway, which is owned or controlled by the Wabash Railway Company. The company has provided an ore dock and coal dock, and has expended a considerable sum of money in deepening and maintaining the channel between the jetties and outward into the lake. The last work done by the company was in the spring of 1902. The work thus done has sufficed to secure a narrow channel not less than 20 feet in depth. Periodical dredging is necessary to maintain it. The company has recently increased its wharf room and improved its apparatus for loading and unloading cargoes, and an increase of business at the harbor is looked for.

The principal commodity received is iron ore, and coal is the principal shipment. The total amount received and shipped in the calendar year 1902 was 791,269 tons, which exceeds the business of the previous year by more than 100,000 tons.

Last year the United States removed a length of about 240 feet of the west jetty and replaced it by a new structure, and the present appropriation is being applied to the renewal of about 500 feet more of the same jetty. The east jetty, with the exception of a short section at the outer end, is in a ruinous condition. The channel is too narrow for vessels to enter safely.

In my judgment the harbor is well worthy of improvement so as to secure a depth of not less than 20 feet, and at the same time it should be given a wider entrance by completely removing the east jetty and building a new one not less than 150 feet farther away from the west jetty.

The last complete survey of this harbor was made about nine years ago and the map is published in the Report of the Chief of Engineers for 1894, opposite page 2402. Since then soundings have been made from time to time, but they generally have been limited to the channel or its immediate vicinity.

In my opinion a survey is necessary to determine the present conditions, and this survey should include a complete set of soundings for at least 2,000 feet on each side of the harbor entrance, and the soundings should be carried up the river for not less than a mile, and such of the bank topography as is necessary should be obtained. Borings should also be made to develop the character of the foundation for the new east jetty and also to determine the character of material that will have to be removed by dredging. I estimate that it will cost the sum of $500 to make this survey and prepare the map. I would, therefore, recommend that this amount be allotted for the purpose.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., February 13, 1903.*

Respectfully forwarded to the Chief of Engineers recommended for approval.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 18, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of

Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 10, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer and the indorsement of the division engineer.

In the opinion of the Board the commerce involved is of such extent and character as to render Huron Harbor, Ohio, worthy of improvement by the United States to the extent contemplated in the act of June 13, 1902, and as recommended by the district officer and division engineer.

The Board therefore recommends that there be made an allotment of $500 for a survey and estimate of cost.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*March 14, 1903.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Huron Harbor, Ohio, authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Fifth indorsement.]

WAR DEPARTMENT,
*March 17, 1903.*

Approved as recommended by the Acting Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 5, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., September 11, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The accompanying report of the district officer contains a project for the improvement of Huron Harbor at a cost of $312,000.

The proposed channel, especially that part of it which lies beyond the ends of the proposed piers, will not be self-maintaining. As this Board is required by section 3 of the river and harbor act of June 13, 1902, to consider cost of maintenance, as well as cost of construction, it is requested that the district officer be called on for an estimate of the cost of maintaining the proposed channel.

The Board doubts the advisability of using a sand core in the east jetty. Incidentally, the practicability of constructing a sand core with slopes as steep as those shown on the small tracing accompanying the district officer's report is open to question. It is requested that the district officer be asked to prepare an estimate of the cost of a jetty composed entirely of rock.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

[Eighth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 17, 1903.*

Respectfully returned to Major Kingman with request that he prepare and submit the additional report and estimates desired by the Board of Engineers for Rivers and Harbors.

To be returned through the division engineer.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Ninth indorsement.]

U. S. ENGINEER OFFICE,
*Cleveland, Ohio, September 24, 1903.*

Respectfully returned to the Chief of Engineers, with the following additional information called for:

To construct the proposed jetty entirely of stone would simply involve substituting stone for the 2,500 cubic yards of sand. This would require 3,700 tons of small stone, or the ordinary run of a quarry, which would cost in place $1.20 a ton; in all, $4,480. Deducting from this the $1,000 which was the estimated cost of the sand in place, and the remainder would be $3,500 in round numbers, which will be the increased cost of the project.

In regard to the cost of maintenance, I am of the opinion that there would be necessary an average annual dredging to the amount of 10,000 cubic yards of sand or comparatively light material. Under the present arrangement I do not think that it would be safe to estimate this at less than 25 cents a yard, or $2,500 per annum for maintenance. The use of the hydraulic dredge, the construction of which was authorized by the last river and harbor act and which I understand is now being built, will probably materially reduce this cost of maintenance, but I do not think it prudent to base an estimate upon the use of this dredge at this time.

I fully agree with the conclusion of the Board that the sand core would not stand at as steep a slope as was shown on the harbor side unless great care was taken in placing it and holding it with the stone. The particular form of cross section was more for the purpose of estimating the quantity. If sand was used, two parallel ridges of stone should first be constructed and the sand in the required quantity deposited between them. It would, no doubt, be flatter than indicated on the drawing.

DAN C. KINGMAN,
*Major, Corps of Engineers.*

(Through the Division Engineer.)

[Tenth indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., September 28, 1903.*

Respectfully forwarded to the Chief of Engineers.

The use of a sand core to the small extent recommended by the district officer seems to me an experiment sufficiently promising to justify its trial. If unsuccessful the loss will not be great, while if successful the saving will be considerable.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Eleventh indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, October 1, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors, inviting attention to the eighth, ninth, and tenth indorsements hereon.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Twelfth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 13, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The extent of the present commerce of Huron Harbor and the prospect that an increase of depth in the entrance will be followed by corresponding commercial benefits are set forth in the accompanying papers and indicate that it is advisable for the United States to undertake the improvement of this harbor. The plan proposed by the district officer and approved by the division engineer commends itself to the Board.

The Board is of opinion that it is desirable for the United States to undertake the improvement of the entrance to Huron Harbor, Ohio, in accordance with the plan proposed by the district officer, at a first cost of $315,500 and an annual expenditure of $2,500 for maintenance.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## SURVEY OF HURON HARBOR, OHIO.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cleveland, Ohio, August 1, 1903.*

GENERAL: The river and harbor act approved June 13, 1902, required a survey to be made of Huron Harbor, Ohio, with a view to securing a channel with a depth of 20 feet. In obedience to instructions of the Chief of Engineers, I have caused a survey of this harbor to be made, and I have the honor to submit the following report concerning it:

The harbor of Huron, Ohio, is situated at the mouth of the Huron River where it enters Lake Erie, at a point about 10 miles eastward from the city of Sandusky. The first work of improvement at this harbor was done in 1827 under an appropriation of $5,000, made by Congress in the previous year. At this time the river afforded an abundant depth of water for all of the vessels then in use for a distance of 6 miles upward from its mouth. The mouth of the river, however, was obstructed by a sand bar, which was sometimes bare at low water.

The plan of improvement provided for the construction of two jetties extending outward into the lake for the purpose of concentrating the current of the river and washing away the bar. The jetties were well planned for the purpose in view. They were built parallel to each other and about 140 feet apart, a distance somewhat less than the average width of the river. The effect of these works was to cause the current to wash away the sand and even to erode the clay underlying it. Six years after the work was begun a depth of 10 feet or 12 feet was reported across the bar. This seemed to be about the limit of improvement which could be secured by these works by the natural force of the current alone.

In 1845 dredging was resorted to to secure a greater depth to meet the increasing demands of commerce. In 1890 the project was enlarged to provide for extending the jetties to a depth of 16 feet of water in the lake and to secure a corresponding depth between them by dredging. The outer ends of the jetties are still several hundred feet short of the proposed line of extension.

The total amount expended for all purposes of construction and maintenance at this harbor from 1826 to June 30, 1903, is $222,227.18, and there was at that time a balance unexpended of about $15,500.

The Wheeling and Lake Erie Railway Company has erected an extensive iron-ore and coal dock at Huron Harbor, and under authority of the Secretary of War has dredged the channel between the jetties and outward into the lake to a depth of 20 feet. The last work of dredging done by this company was in the spring of 1902. The depth maintains itself fairly well, but the channel is very narrow.

The receipts and shipments at this harbor for the calendar year 1902 amounted to nearly 800,000 tons. The business is increasing, and there is no doubt that the harbor is worthy of improvement. What it needs is a wider and better entrance to the jettied channel and that the Government should assume the burden of securing and maintaining a navigable depth of 20 feet.

Since the jetties are only 140 feet apart, a width entirely insufficient to permit large vessels to enter the channel with safety, a greater width can only be secured by abandoning one of them and rebuilding it farther away from the axis of the channel. The west jetty is in the best condition of the two. There is a length of 340 feet at its outer end which was built between the years of 1891 and 1896, the substructure of which is in good condition and is capable of being repaired and used. There is also a length of 610 feet of new jetty work now under construction which is composed of timber cribs with a continuous timber superstructure. It is first-class work of its kind, and is so built that when the superstructure decays it can be easily rebuilt of concrete. There is also about 600 feet at the shoreward end of the jetty which is in a ruinous condition, and which is composed of small cribs sunk upon the natural bottom which would not admit of repair, but which must be entirely removed and rebuilt. The west jetty therefore consists of about 950 feet of work which can be utilized and about 600 feet which must be abandoned. The east jetty, owing to the shape of the shore line, is shorter than the west one. There is a length at the outer end of about 150 feet which is fairly good and is similar to the outer end of the west jetty, and there is in addition about 730 feet which is entirely worthless. It would seem best, therefore, in order to secure the desired width of channel to abandon the east jetty and rebuild it farther to the eastward.

The west jetty should first be extended about 240 feet, and a pierhead 50 feet square consisting of a timber crib with a concrete superstructure should be provided at its outer extremity, this structure being specially designed to support a light-house, fog whistle, etc. The opening between the jetties should be not less than 300 feet, and the east jetty should terminate at its outer extremity in a pierhead similar to that proposed for the west jetty.

Now, this new east jetty might be built parallel to the west one and similar to it in construction, but inasmuch as the jetties are no longer active works in securing and maintaining the channel, but have for their object simply to protect a channel secured by dredging, there is no reason why they should be built parallel to each other or why they should be placed at the edge of the channel. They may have any position with respect to the channel which will protect it from the wash due to the lake waves.

Owing to the constantly increasing difficulty of obtaining timber suitable for the construction of cribs and to the corresponding increase in the cost of works of this character, it seems to me to be extremely desirable to resort to some other form of construction whenever it is practicable to do so; and there seems to me in this case no reason why a new east jetty should not be constructed of a rubblestone mound placed so far away from the channel that there will be no danger of its being undermined by the dredging. In this way it can be built upon the natural bottom of the lake and the desired result obtained with the minimum amount of material.

There is submitted herewith a proposed form of cross section for the east jetty. In deep water it has a core of sand covered with a comparatively thin layer of small stone. Upon this it is built up, of large blocks of stone deposited in such a way as to secure the general form of section desired without any particular effort to secure a smooth and even surface by laying the stone in the form of a pavement. If large blocks of stone are used, that is to say, stones weighing from 6 to 10 tons each, which can be easily and cheaply obtained, I think there will be no danger of their being disturbed in position by any of the forces to which they will be exposed.

If, however, any portion of the work is moved, either by settlement or by the force of the waves, it is easy to restore it by the addition of more stone without the trouble and expense of bonding in, as in the case of a pavement. I would recommend that this structure extend from the pierhead inward to the shore, but not parallel to the west jetty—that it diverge from it so as to strike the shore at a considerable distance away from the river. This will permit a turning basin to be excavated between the jetties, and will also permit one or more slips to be dug in to the shore for the use of vessels. To prevent the structure from being undermined by dredging I would recommend that no excavation be made nearer the toe of the slope than 10 times the depth to be dug. This will allow a 1-on-10 slope from the toe of the jetty to the bottom of the cut, a slope at which the material will undoubtedly stand. The lake bottom in this vicinity is of hard, blue clay overlaid by a small amount of sand. In order to secure a navigable depth of 20 feet at mean lake level I would recommend that the dredging be made 21 feet, and I have estimated accordingly.

On the chart I have shown by shading the area to be dredged. In the angular space between the east jetty and shore line there is an area shaded in the reverse direction. This might be dredged ultimately whenever a proper bulkhead was built along the shore line, but it is not provided for in the present estimate.

The following is the estimate of quantity and cost for the construction of the rubble mound jetty:

| | |
|---|---|
| 2,500 cubic yards of sand, at $0.40 per yard | $1,000 |
| 3,000 tons of small stone, at $1.20 per ton | 3,600 |
| 50,000 tons of heavy riprap, at $1.55 per ton | 77,500 |
| Total | 82,100 |

If, instead of the rubble mound jetty as proposed, a timber crib with a concrete top structure was employed and was built parallel to the west jetty, it would, of course, be considerably shorter, but it would cost not less than $160,000, and it would not form as good a harbor.

The following is an estimate of the cost of all the work to be done for the improvement of this harbor:

| | |
|---|---|
| Rubble mound jetty, as above | $82,100 |
| Two pier heads, 50 feet square, with concrete superstructure, at $17,000 each. | 34,000 |
| 240 linear feet of jetty, timber cribs with concrete superstructure, 24 feet wide, at $140 per linear foot | 33,600 |
| 580 linear feet of jetty, timber cribs with concrete superstructure, 20 feet wide, at $125 per linear foot | 72,500 |
| 340 linear feet of old jetty, sheathed with oak, and new concrete superstructure, at $50 | 17,000 |
| 670 linear feet of old jetty removed, at $6 | 4,020 |
| 200,000 cubic yards of dredging, at $0.20 a yard | 40,000 |
| Total | 283,220 |
| To which should be added 10 per cent for inspection and other contingencies. | 28,322 |
| Total | 311,542 |
| Or, in round numbers, the proposed improvement will cost | 312,000 |

There will be a balance of funds on hand after the present work is completed which can be applied toward the improvement, $7,000, leaving the amount to be appropriated for the completion of the new project $305,000.

The crib work can best be done at this place by hired labor, and the concrete and rubble work by contract. Two years would be a sufficient time in which to complete the improvement.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., August 18, 1903.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

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## P P 13.

## PRELIMINARY EXAMINATION OF PORTAGE RIVER, OHIO, TO OAK HARBOR BRIDGE.

[Printed in House Doc. No. 189, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith report dated June 13, 1903, by Maj. Dan C. Kingman, Corps of Engineers, on preliminary examination of Portage River, Ohio, to the Oak Harbor Bridge. This examination was made in pursuance of a requirement in the river and harbor act of June 13, 1902, and Major Kingman expresses the opinion, which is concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers, that no improvement of the river is advisable or necessary.

The Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act, states in its report of July 31, 1903, that it is not advisable at this time for the United States to undertake the improvement, and I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

## REPORT OF MAJ. DAN C. KINGMAN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cleveland, Ohio, June 13, 1903.*

GENERAL: I have the honor to report that in compliance with the river and harbor act of June 13, 1902, and in obedience to instructions of the Chief of Engineers, I made a personal examination of the Portage River, in the State of Ohio, from its mouth to Oak Harbor, on the 28th day of May, 1903, and the following is my report in regard to it:

The Portage River lies wholly in the State of Ohio. Its drainage basin is comparatively small, being only about 831 square miles in area. It lies between the basins of the Maumee and Sandusky rivers. Owing to the limited area of its watershed, its discharge can never be very great. On the portion of the river examined it is more like a shallow arm of the lake than an ordinary fresh-water river, and upon this portion the current flows alternately upstream and downstream, depending upon the oscillations of the lake level.

The harbor of Port Clinton is situated at the mouth of this river. This harbor was first examined by the United States in 1870, and at that time there was a narrow channel from the river to the lake about 6 feet in depth. A plan was prepared for its improvement so as to gain a depth of 8 feet, and this plan was afterwards modified so as to afford a greater depth, but it was not until ten years afterwards that a depth as great as 10 feet was secured. Within the last year the depth between the jetties and outward into the lake has been increased to 12 or 13 feet by dredging, but in the inner harbor the depth still remains at about 10 feet. It follows, therefore, that in the natural condition navigation between the lake and the river must have been limited to a depth of 6 feet. Since the improvements have been made a 10-foot navigation would have been possible if the depths in the river permitted it. The only map[a] of the river which I could obtain was one that was furnished by the county surveyor, and it is evidently compiled from township maps and must, therefore, represent the condition as it was at the time of the original land survey. On the upper portion of the river there have been some changes in the bends, probably due to caving banks, but the general shape is as shown upon the map.

I engaged at Port Clinton a small tug having a draft of 6 feet and a pilot who was said to be thoroughly acquainted with the navigation of the river. I directed him to follow the channel of the river as closely as he could, and I caused soundings to be taken throughout the entire distance from Port Clinton to Oak Harbor, both in going up the river and in coming down. Immediately above Port Clinton the river widens out, and its average width for nearly 6 miles is at least 2,000 feet. Above this, for the remaining distance, also about 6 miles, to Oak Harbor, the width is less, but it seems to be everywhere as much as 700 feet wide. I could not ascertain what the original depth of the river had been, but the bottom is generally very soft mud, and there has no doubt been a considerable reduction in depth in recent years due to the wash from cultivated land. The average depth in the river for the first 6 miles is 7 feet or less; in some places we found only 5 feet. On the upper portion of the river there are many shoal places, but these alternate with pools of considerable depth. The country through which the river flows is low and flat, and is apparently a very fertile, well-cultivated farming country. It was formerly heavily timbered, and until the timber was cut off and removed the river was quite extensively used for the transportation of forest products.

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[a] Not printed.

Port Clinton is the largest town on the river, and has a population of about 2,500. Oak Harbor is the second town in size, and its population is about 1,600. Both of these towns are in the same county, and the total valuation of the county is said to exceed $8,000,000. In 1896 the county appropriated the sum of $2,500 for the improvement of the river, and this was expended in dredging between Oak Harbor and Port Clinton. The county surveyor states that dredging was done upon three bars, from 1,300 to 4,500 feet in length. The aggregate length of the cut was 8,200 feet; its depth, 9 feet; its width, 40 feet. The greatest depth of this excavation was 3 feet. Of course, since the cut was so narrow and the bottom so soft, very little trace of it now remains.

This river could no doubt be considerably improved by dredging, but the work would not be permanent. The limit of improvement would seem to be the ruling depth in the harbor of Port Clinton, which is to say 10 feet, and I should think that the cut ought to be at least 150 feet wide in order that it should be at all permanent. Without a survey it is impossible to give anything more than a very general estimate of the amount of work that would be necessary to afford such a channel between Oak Harbor and Port Clinton. I am of the opinion, however, that the amount of material necessary to remove would not be less than 600,000 cubic yards, and if this work could be done at the very low price of 12 cents a yard, including the cost of inspection, it would cost $72,000.

I could not discover any present or prospective commerce on the river to justify such an expenditure. I spent two or three hours at Oak Harbor and met and talked with a number of the principal citizens. I explained the object of my visit to the editor of the local paper, and he promised to give publicity to the fact of my examination and to invite (as I did personally) all persons interested in the improvement of the river to communicate with me at the engineer office in Cleveland. On my return to Port Clinton I talked with the principal citizens of that place who might be interested in the improvement of the river, and invited them in like manner to communicate with me in writing. This was two weeks ago, and I have not received any communications and I do not expect to receive any.

There appears to be no business at present on the river except the transportation of a few logs in rafts, and the navigation of the river is by small fishing boats. I was told that a steamboat formerly ran regularly from Oak Harbor to the islands at Put in Bay, and that a very considerable business was done between these points in the transportation of passengers and farm products. It was said that this boat was compelled to discontinue its trips on account of the increasing difficulties of navigation in the river. No doubt a less degree of improvement than that suggested above might be made at a correspondingly less cost, but I do not think that the river could be used by ordinary lake vessels if it afforded a less draft than 10 feet.

The town of Oak Harbor is not without transportation facilities, for it has two important railway lines passing through it. The river in its present condition might be navigated by a specially constructed light-draft boat which could safely and cheaply carry the farm products to Port Clinton, where they could be transferred to lake vessels. A 5-foot navigation on western rivers is considered sufficient for useful purposes.

A survey of this river, in order to furnish all information necessary for the preparation of a definite plan for its improvement, would cost about $2,000; but in my opinion no improvement of the river is advisable or necessary and no survey need be made.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., June 15, 1903.*

Respectfully forwarded to the Chief of Engineers.

I concur in the opinion that the improvement of Portage River at this time is not advisable.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*June 24, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 31, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a preliminary examination of "Portage River to the Oak Harbor Bridge," the indorsement of the division engineer thereon, and all other data available, including a number of letters from interested persons.

At the mouth of Portage River lies Port Clinton Harbor. The entrance channel is 12 feet deep and the inner harbor 10 feet deep.

The governing depth in the river between Port Clinton and Oak Harbor appears to be about 5 feet. The improvement desired by interested parties, as appears from communications received, is a channel 12 feet deep from Lake Erie to Oak Harbor, a distance of 12 miles. The district officer considers that to obtain a channel 10 feet deep and

150 feet wide would require the removal of not less than 600,000 cubic yards of material.

The present commerce of the river above Port Clinton is insignificant. The desire for the improvement is based upon the belief that with 12 feet of water the farm products and manufactures of the country contiguous to the river would find a cheaper route to market than is afforded by existing land transportation, and that the rates on articles imported, chief among which are coal and lumber, would be greatly reduced. The benefit of the desired improvement, however, would not extend beyond the limits of Ottawa County, the total population of which is but 22,213. Port Clinton has a population of 2,450 and Oak Harbor of 1,631. As given in the report of the Twelfth Census, Ottawa County ranks among the last 20 counties in the total of 89 in the State of Ohio in the value of farm products and of manufactured articles. The import trade is local, being concerned chiefly with articles for home consumption and not for distribution. Moreover, there is practically no commerce on the river, although the present depth is as much as is afforded by many streams on which a large traffic is carried on and is sufficient for the economical transportation of farm products and other articles to Port Clinton, where they could be transshipped to lake vessels.

No depth less than 10 feet would suffice for lake vessels, and the Board believes that the commerce that would be produced by such a depth of channel would be totally incommensurate with the cost of the work.

The Board concurs with the district officer and the division engineer in the opinion that it is not advisable at this time for the United States to undertake the improvement of Portage River up to Oak Harbor Bridge.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

## P P 14.

## PRELIMINARY EXAMINATION OF ROCKY RIVER HARBOR, OHIO.

[Printed in House Doc. No. 87, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a report, dated September 6, 1902, by Maj. Dan C. Kingman, Corps of Engineers, on preliminary examination of Rocky River Harbor, Ohio, ordered by the river and harbor act of June 13, 1902. Major Kingman gives a history of operations by the General Government heretofore carried on for the improvement of this locality, and expresses the opinion that it might be desirable to make certain small repairs to the existing jetty, and this opinion is concurred in by the division engineer, Lieut. Col. O. H. Ernst, Corps of Engineers.

The Board of Engineers for rivers and harbors has reviewed this report in accordance with the provisions of sections 3 and 14 of the above-mentioned act, but concludes in its report of December 2, 1902, that it is not desirable to continue the improvement of this locality. I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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### REPORT OF MAJ. DAN C. KINGMAN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cleveland, Ohio, September 6, 1902.*

GENERAL: In obedience to instructions contained in the Department letter of June 23, 1902, I have the honor to submit the following report of a preliminary examination of Rocky River Harbor, Ohio, which was required to be made by section 14 of the river and harbor act approved June 13, 1902:

Rocky River, Ohio, rises in the northern part of the State, and flows northwardly, emptying into Lake Erie at a point 5¼ miles westward from the entrance to the harbor of Cleveland. The harbor at its mouth has been improved by the United States.

The following is a history of the work taken from the Reports of the Chief of Engineers.

#### 1870.

The attention of the General Government was first called to this locality by the act of Congress approved July 11, 1870, wherein a survey of the mouth of the river was ordered. This survey was made under the direction of Maj. W. McFarland, of the Corps of Engineers, in October and November, 1870.

#### 1871.

In January Major McFarland submitted a chart of the harbor with a plan and estimate of its improvement. The following is an extract from his report:

> The survey of this river was limited to that portion lying below the bridge over which the main road from Cleveland to the West passes, as no part above the bridge could be rendered available for the purpose of navigation.
>
> By examining the map it will be seen that in its passage from the bridge to Lake Erie, a distance of about 1,000 yards, the river divides into two branches, which, after encompassing an upper and a lower island, unite again and enter the lake between a high rocky bluff on the west and a low sand spit on the east.
>
> The eastern branch varies from 150 to 250 feet in width and the western branch from 75 to 100 feet in width. The depth of water from the bridge to the head of the upper island varies from 2 to 3 feet; here, however, it begins to deepen slightly, and near the foot of the island 6 feet of water is found. This depth, with four slight variations, is carried to the outer bar, where the water shoals again to nearly 4 feet.
>
> Soundings were taken over this whole area from the bridge to the 18-foot curve in

the lake, at distances of 10 feet on lines averaging 100 feet apart, and borings to the rock substratum were also made at distances of 20 feet apart, on lines averaging 200 feet apart. The results attained show that the bottom consists of sand chiefly, below which, at depths varying from 1 to 4 feet, rock is found.

Major McFarland reported that to make the harbor available, either for commercial purposes or as a harbor of refuge, would require a large amount of dredging and the construction of an east pier.

### 1872.

The first appropriation of $10,000 was made by the act of June 10, 1872. Maj. and Bvt. Lieut. Col. George L. Gillespie, Corps of Engineers, then in charge of the work, recommended that the appropriation should be applied to the construction of a pier starting from the sand beach on the east side of the river, about 250 feet from the bluff on the west side, and running out into the lake. This project was approved and contracts were made for the work. In the Annual Report for 1872 Colonel Gillespie stated that no further appropriations were recommended.

### 1873.

Colonel Gillespie was relieved by Maj. and Bvt. Lieut. Col. F. Harwood, of the Corps of Engineers, in April, 1873.

Operations were commenced upon the construction of the east pier in April and continued until the last of August, when 360 linear feet of it was completed.

In his annual report for 1873 Colonel Harwood submitted an estimate of $250,000 for completing the harbor and $50,000 for work for the ensuing year, closing his report as follows:

> I accordingly make this estimate, it being understood that such estimate conveys no recommendation for further appropriation, a matter which is respectfully submitted to the better judgment of Congress.

### 1874.

An appropriation of $10,000 was made by the act of June 23, 1874. Colonel Harwood was relieved by Lieut. Col. and Bvt. Col. C. E. Blunt, of the Corps of Engineers, June 30, 1874.

Contracts were made in August for extending the east pier; work was commenced in September, and by the close of the year the pier had been prolonged 288 feet.

### 1875.

An appropriation of $15,000 was made by the act of March 3, 1875. Contracts were made in June for prolonging the east pier and dredging the channel at the entrance. Operations were commenced in August, and by the close of the year the east pier had been prolonged 180 linear feet, and 31,820 cubic yards of sand and shale had been removed from the channel.

### 1876.

Some minor repairs were this year made to the outer end of the pier. In his annual report for 1876 Colonel Blunt made the following statement:

> Sufficient money is thought to have been expended at this point, and no further extension is recommended.

No further work was done, nor any further appropriations made for this harbor.

### 1878.

The freshet in the spring of 1878 cut a new channel through the sand beach around the inner end of the pier, undermined and carried away about 80 feet of the pier, and seriously damaged the work.

### 1879.

In July, 1879, Maj. and Bvt. Col. John M. Wilson, Corps of Engineers, reported the damage that had occurred during the previous year, and submitted an estimate of $5,000 for the repair and preservation of the pier.

### 1880.

An appropriation of $4,000 for the repair of the pier was made by the act of June 11, 1880. This sum will be applied to the repairs, and it is anticipated that it will be sufficient for that purpose.

The total amount appropriated for this work up to the close of the present fiscal year is $39,000, of which sum $35,000 has been expended.

No further appropriation is asked for.

The $4,000 which was on hand in 1880 was expended in repairing and maintaining the existing work as required until 1883. Since then no funds have been available and nothing has been done at this place.

On the 15th of August, 1902, I made a personal examination of the locality without expense to the United States. I caused a line of soundings to be taken along the center of the channel and inward to the foot of the island. The accompanying blueprint[a] is a copy of a map on file in this office, and the soundings made August 15, 1902, are indicated in red. These soundings would seem to show that no great change has taken place in the depth in the harbor in the last twenty years. The superstructure of the jetty, which is about 900 feet long, is, as might be expected, in an almost ruinous condition, and in places is entirely gone. If the substructure is good and still in place, it might be permanently protected by a covering of large stone, as was done at Port Clinton, Ohio, and the work would then be as useful as it ever was. A small amount of dredging outward beyond the jetty would make the harbor safer and more convenient to enter.

The commerce of this place is not great, but the harbor is extensively used by yachtsmen and is of considerable value to them. I inclose herewith copies of letters which I have received, which give a good idea of the extent to which this harbor is used. The United States has expended $39,000 here and has something of value. I do not think a large commercial harbor is desirable or necessary at this place, or that a large appropriation should be recommended, but it might be worth while to make the small repairs above indicated, and their extent and probable cost could only be determined by a survey. I think that the place is worthy of such a survey and that the cost would be $400. If this recommendation is approved I would respectfully ask for authority to employ any of the men or plant in the district for the purpose of making the survey.

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[a] Not printed.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., September 8, 1902.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
*Lieut. Col., Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
*September 13, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 2, 1902.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of Major Kingman on the preliminary examination of Rocky River Harbor, Ohio.

In the opinion of the Board it is not desirable to continue the improvement of this locality. It appears that there is little or no commerce involved, almost all vessels using the harbor being pleasure craft.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## LETTER OF THE CLIFTON PARK LAND AND IMPROVEMENT COMPANY.

CLEVELAND, *September 2, 1902.*

DEAR SIR: In reply to your inquiry regarding the number of vessels of all kinds using Rocky River as a harbor and for other purposes, we inclose herewith a list furnished by the Lakewood Yacht Club Company, whose vessels are moored at Rocky

River, and a list furnished by the Cleveland Yacht Club, a number of which are moored at the river, and others running in from time to time.

In addition to these we inclose a list of other vessels which use the river as occasion requires and the number of vessels used for fishing purposes by Captains Horn and Slater, whose headquarters are on the river and whose fishing grounds are 3 or 4 miles distant.

It is possible that a much larger number of vessels than the above use the river, but as no record has been kept it is impossible to give the particulars. Hoping this information may be of service to you, we remain,

Very truly, yours,

The Clifton Park Land and Improvement Company,
J. J. Crooks, *Secretary and Treasurer.*

Maj. D. C. Kingman.

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### LETTER OF THE LAKEWOOD (OHIO) YACHT CLUB.

Cleveland, Ohio, *August 30, 1902.*

Dear Sir: Inclosed please find a list of boats belonging to the Lakewood Yacht Club. All of these boats are moored at Rocky River, Ohio:

| Name. | Length over all. | Draft. | |
|---|---|---|---|
| *Cabin boats (sailing).* | *Feet.* | *Ft.* | *in.* |
| Mona | 39 | 5 | 9 |
| Ynat | 28 | 4 | 2 |
| Au Revoir | 38 | 5 | 8 |
| Unique | 28 | 2 | 8 |
| Frolic | 32 | 5 | 6 |
| Emma | 30 | 2 | 6 |
| Meteor | 39 | 5 | 10 |
| Anne | 40 | 6 | 8 |
| Corsair | 43 | 6 | 10 |
| Dreamer | 32 | 3 | 2 |
| Vinca | 31 | 3 | 0 |
| Ada W | 39 | 7 | 0 |
| Grayling | 42 | 6 | 4 |
| Marietta | 53 | 4 | 0 |
| Argo | 25 | 4 | 9 |
| Susie | 50 | 5 | 6 |
| White Wings | 63 | 3 | 4 |
| Growler | 21 | 3 | 9 |
| Bessie | 32 | 5 | 7 |
| Com. Gardner | 36 | 6 | 0 |
| Cygnet | 34 | 6 | 2 |
| Shamrock | 42 | 4 | 6 |
| Jane | 42 | 6 | 5 |
| Restless | 40 | 5 | 6 |
| *Open boats (sailing).* | | | |
| Truant | 21 | 0 | 14 |
| Satan | 17 | 1 | 0 |
| Nadjy | 17 | 1 | 2 |
| Jag | 20 | 1 | 0 |
| Lark | 16 | 1 | 0 |
| Marion | 16 | 9 | 9 |
| Player | 25 | 1 | 2 |
| Wrinkle | 27 | 1 | 0 |
| Mist | 25 | 1 | 6 |
| Daphne | 24 | 1 | 6 |
| 7 sailing dories | 17 | 0 | 8 |
| *Power boats.* | | | |
| May | 20 | 1 | 6 |
| U. S | 19 | 1 | 4 |
| Melinie | 40 | 4 | 6 |
| Glendora | 40 | 4 | 0 |
| F. C. Case launch | 25 | 2 | 0 |

C. O. Peterson, *Secretary.*

The Clifton Park Land and Improvement Company, J. J. Crooks, *Manager.*

### LIST OF YACHTS ENTERING ROCKY RIVER BELONGING TO THE CLEVELAND (OHIO) YACHT CLUB.

[Furnished by the Cleveland (Ohio) Yacht Club.]

| | |
|---|---|
| Schooner *Manitou* | 49-foot water line. |
| Yawl *White Wings* | 55-foot water line. |
| Schooner *Susie* | 35-foot water line. |
| Sloop *Shamrock* | 30-foot water line. |
| Cutter *Mona* | 27-foot water line. |
| Sloop *Commodore Gardner* | 28-foot water line. |
| Sloop *Compeer* | 27-foot water line. |
| Sloop *Mischief* | 25-foot water line. |
| Yawl *Owl* | 23-foot water line. |
| Sloop *Kid* | 23-foot water line. |
| Catboat *Dorthy* | 25-foot water line. |
| Sloop *Celox* | 16-foot water line. |
| Steamer *Say When* | 123-foot water line. |
| Launch *Thelma* | 70 feet over all. |
| Launch *Kanaka* | 47-foot water line. |
| Launch *Meline* | 48 feet over all. |
| Launch *Luella* | 45 feet over all. |
| Launch *Kite* | 30 feet over all. |
| Launch *Clover* | 30 feet over all. |
| Launch *Janie S.* | 25 feet over all. |
| Launch *Speedaway* | 27 feet over all. |
| Launch *Scout* | 25 feet over all. |
| Launch *Pastime* | 21 feet over all. |
| Launch *Lady Lou* | 21 feet over all. |
| Launch *Cuba* | 18 feet over all. |
| Launch *Chu-Chu* | 18 feet over all. |
| Launch *Maud* | 18 feet over all. |
| Launch *Catharine* | 18 feet over all. |
| Launch *Kid* | 18 feet over all. |
| Launch *Indian* | 18 feet over all. |
| Launch *Pup* | 17 feet over all. |
| Launch *Doris* | 15 feet over all. |

THE CLEVELAND YACHT CLUB,
E. E. PETTIBONE,
*Secretary and Treasurer.*

### LIST OF CERTAIN FISHING AND OTHER VESSELS USING ROCKY RIVER, OHIO.

[Furnished by Captains Horn and Slater.]

Schooner *C. H. Kimble*.
Yacht *West Wind*, Buffalo.
Yacht *Josephine*, Toledo.
Yacht *Louise*, Port Clinton.
Yacht *Nancy*, Toronto, Canada.
Steamer *Dan Kuntz*, Cleveland.
Steamer *Chisholm*, Cleveland.
Fishing smack *I. C. U.*, 30 feet over all.
Fishing smack *Mink*, 40 feet over all.
Fishing smack *Sunrise*, 34 feet over all.
Launch *San Toy*, 20 feet over all.
Launch *Olga*, 40 feet over all.
Launch *Rex*, 20 feet over all.
Launch *St. Marie*, 25 feet over all.
Sailing yacht *Alice*, 24 feet over all.
Sailing yacht *C. Howley*, 26 feet over all.
Captain Horn, 1 tug, 46 feet long.
2 fishing smacks, 30 feet long each.
1 steam pile driver.
Captain Slater, 1 tug, 2 fishing smacks, and 1 pile driver.

## P P 15.

# PRELIMINARY EXAMINATION OF SANDUSKY RIVER, OHIO, FROM ITS MOUTH TO FREMONT.

[Printed in House Doc. No. 242, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith report, dated April 27, 1903, by Maj. Dan C. Kingman, Corps of Engineers, on preliminary examination of Sandusky River, Ohio, from its mouth to Fremont, authorized by the river and harbor act approved June 13, 1902. In his opinion the improvement of the locality to the extent of securing a depth of 9½ feet is desirable if it can be accomplished at a reasonable cost, and this opinion is concurred in by the division engineer, Col. O. H. Ernst, Corps of Engineers.

The Board of Engineers for Rivers and Harbors has reviewed this report, in accordance with the provisions of sections 3 and 14 of the above-mentioned act, and submits report in indorsement of June 12, 1903, thereon. Careful consideration has been given by the Board to available data, and a public hearing was held at Fremont, at which interested parties appeared and advocated the improvement. A full history of the commerce and the operations heretofore carried on by the United States for the improvement of this stream is given in its report, and for reasons stated the Board concludes that it is not advisable for the United States to undertake the further improvement of Sandusky River from its mouth to Fremont.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## REPORT OF MAJ. DAN C. KINGMAN, CORPS OF ENGINEERS.

Engineer Office, United States Army,
*Cleveland, Ohio, April 27, 1903.*

General: In compliance with instructions contained in the Department letter of June 23, 1902, and under authority of the river and harbor act of June 13, 1902, I have the honor to submit the following report of a preliminary examination, made by me, of the Sandusky River in the State of Ohio, from its mouth to the city of Fremont:

This river has already had a considerable sum of money expended upon it for its improvement. The earliest work known to have been done consists of dredging on certain bars in the river, which was paid out its length, and of the upper end of Sandusky Bay; the location of all obstructions, all needed information as to the character and composition of the bottom and banks of the river, and the volume of its low-water discharge.

The work could best be done by the officers and crew of the United States survey boat belonging to the district. It is estimated that a proper survey will cost, including the preparation of the maps, the sum of $1,500, and the time required to make it will be about two months. The work would necessarily be somewhat interfered with by other operations in the district. I do not, however, think it advisable to again take the survey boat through the mud bar at the upper end of the bay until something is done to afford a better channel for it. In coming out of the river a mass of fence wire was picked up by the screw and twisted around the shaft in such a way as to partially disable the boat until it could be gotten at and removed.

The U. S. dredge *Maumee* will be taken in a few weeks to Huron to remove a portion of the old west pier. While on its way it could stop at Sandusky and make a shallow cut through the bar at the head of the bay, simply casting the material to one side so as to permit the survey boat to pass in and out with safety. The time required for this would probably not exceed one or two days. In case the survey is authorized and the allotment made I would recommend that I be authorized to do this small amount of dredging as a necessary incident of the survey.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., April 28, 1903.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*May 1, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., June 12, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has given careful consideration to the within report upon a preliminary examination of "Sandusky River from its mouth to Fremont," Ohio, the indorsement of the division engineer, and all other data available. On June 10, 1903, a committee of the Board held a public hearing at Fremont, at which interested parties appeared and advocated the improvement.

The Sandusky River flows into Sandusky Bay about 14½ miles, by the channel of the bay, from Lake Erie. Fremont, Ohio, distant 18 miles from the mouth of the river, had in 1900 a population of 8,439.

When lake harbors were considerably shoaler than now, and before the construction of many of the railways now traversing northwestern Ohio, Fremont was the natural market town for a rich and important agricultural country. Grain was shipped thence to Buffalo by water, and general merchandise was brought back for the use of the neighboring population.

At the time of a survey made in 1880 the condition of the waterway was as follows: In the river proper were ample depths for a 9½-foot navigation except for about five bars, covering an aggregate channel length of about one-half mile, upon which the depths varied between 5 and 9 feet. In the bay immediately beyond the river mouth was a bar about 1½ miles long between 9-foot contours, with depth upon its crest of 7 feet. Study of surveys and examinations made since that date shows that the waterway is to-day much as it was in 1880. While the depths on the bars within the river may be slightly greater, the bar at the mouth is probably somewhat shoaler.

It is reported that prior to 1866 about $17,000 was expended upon the waterway by citizens of Fremont and the county of Sandusky.

Since that date appropriations have been made as follows:

| | |
|---|---|
| 1867 | $20,000 |
| 1872 | 10,000 |
| 1880 | 10,000 |
| 1881 | 7,500 |
| 1882 | 4,000 |
| 1890 | 1,500 |
| 1892 | 5,000 |
| Total | 58,000 |

Projects under which work has been prosecuted have been as follows:

*1867 to 1880.*—To secure a channel from 100 to 200 feet wide and 12 feet deep, at an estimated cost of $68,000.

*1880 to date.*—To secure a channel 100 feet wide and 9½ feet deep, at an estimated cost of $44,000.

The work heretofore done has been confined to dredging, as temporary results of which it may be stated that in 1869 a channel depth of 8 feet was secured. In 1872 the depth was somewhat greater than 8 feet. In 1880, no appropriation having been made for a period of eight years, conditions were as described in paragraph 5. As a result of the expenditure of $21,500, appropriated in 1880, 1881, and 1882, there in the city to deep water in the lake. The jetties were completed, but the full width of channel with a depth of 14 feet was never secured. The funds appropriated in recent years for this locality have not been sufficient for the maintenance of the jetties, the superstructures of which have decayed and are now in a ruinous condition and not effective in keeping the sand out of the channel, which is now so obstructed that the larger class of boats which formerly frequented this harbor can no longer use it.

Major Kingman presents a project for restoring the jetties at an estimated cost of $38,500, and for restoring the channel by dredging at a cost of $2,400, a total, including contingencies, of $45,000 in round numbers, and states that in his opinion the harbor is worthy of improvement to this extent.

Under the provisions of sections 3 and 14 of the above-mentioned act these reports have been reviewed by the Board of Engineers for Rivers and Harbors, and in its report of September 16, 1903, the Board expresses the opinion that it is not desirable for the United States at the present time to do any further work in improvement of the entrance channel at Vermilion, but that it is desirable permanently to repair the piers, as proposed by the district officer, at a cost of $42,350.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF MAJ. DAN C. KINGMAN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Cleveland, Ohio, September 17, 1902.*

GENERAL: In compliance with instructions contained in the letter of the Chief of Engineers, dated June 23, 1902, I have the honor to submit the following report of a preliminary examination made by me of the harbor of Vermilion, Ohio:

The act of Congress approved June 13, 1902, directed a preliminary examination or survey to be made of Vermilion Harbor, Ohio. By taking advantage of a trip of the inspection boat belonging to this district, I visited Vermilion Harbor and made the required preliminary examination without cost to the United States.

This harbor was first improved in 1836 under a project which provided for the construction of parallel jetties extending outward to the 10-foot curve in the lake. The project was subsequently amended so as to provide for obtaining a 12-foot depth by dredging, and in 1880 the proposed depth was increased to 14 feet, which depth was to be provided from the wharves in the city to deep water in the lake. This last project was never fully carried out.

Between 1836 and 1878 there was appropriated and expended the sum of $113,701.28. Since then, in the past twenty-three years, only $19,576.27 have been available for the improvement, and of this sum $400 was a recent allotment not yet expended. The jetties were built as proposed and a portion of the dredging was done, but a full depth and width of 14 feet was never secured. The small amount which has been available during the last twenty-three years has not been sufficient to maintain the existing work. It amounted to less than 1 per cent per annum of the sum previously expended. As a result, the superstructures of the jetties have decayed and are in a ruinous condition and do not now suffice to keep the sand out of the channel, and it is now so obstructed that the larger class of boats which formerly frequented this harbor can no longer use it.

From such inquiries as I have been able to make, it appears that this harbor would be useful locally if it could be restored to its original condition, or if the project of 1880 could be carried out. I inclose herewith copies of a number of letters which I have received, which bear upon this subject. I am of the opinion that the jetties might be repaired and made permanent by covering them with a pavement of heavy riprap, as was done at Port Clinton, and the channel might then be redredged and the harbor restored to a condition which would be useful and which would require thereafter but a very small expenditure for its maintenance.

In order to determine what is necessary to be done, and the probable cost of the same, a survey would be necessary, the estimated cost of which is $250. I would respectfully recommend that such an allotment be made, and that I be authorized to make the survey, using any of the plant or employees of the district which may be available.

Very respectfully, your obedient servant,

DAN C. KINGMAN,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

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[First indorsement.]

OFFICE DIVISION ENGINEER, NORTHWEST DIVISION,
*Chicago, Ill., September 18, 1902.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. ERNST,
*Lieut. Col. of Engineers,*
*Division Engineer, Northwest Division.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 1, 1902.*

Respectfully returned to Major Kingman.

It is not clear from the within report whether Major Kingman is prepared, as a result of his preliminary examination, to offer an opinion as to the worthiness of this improvement.

If Major Kingman requires further data to assist in forming such opinion, he is authorized to extend his preliminary examination so far as may be necessary to obtain the information required, by survey or otherwise; and for this purpose the sum of $250, as requested within, will be allotted upon his further application.

To be returned.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Fourth indorsement.]

ENGINEER OFFICE, U. S. ARMY,
*Cleveland, Ohio, October 4, 1902.*

Respectfully returned to the Chief of Engineers, with recommendation that $250 be allotted for the survey, as required by the second indorsement.

I would also ask that I be authorized in making the survey to use any of the employees or plant now employed in the district.

DAN C. KINGMAN,
*Major, Corps of Engineers.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 14, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., September 16, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within and the accompanying reports of the district officer on a preliminary examination of Vermilion Harbor, Ohio, the indorsements of the division engineer thereon, and other data available, including communications from interested parties.

In 1836, when the improvement of this harbor was begun, the depth of water over the bar was less than 2 feet. Between 1836 and 1874 two piers of cribwork filled with stone were built 125 feet apart. The east pier is 1,075 feet and the west pier 1,125 feet long. Since 1874 no additions have been made to the length of the piers, money appropriated since that time, some $20,000, having been expended in repairs to the piers and in dredging and rock excavation. The piers terminate at the position occupied by the 12-foot contour in 1874. Sand travels around the west pier from the western foreshore and is deposited in an outer bar.

The original project proposed to obtain a depth of 10 feet; this project was subsequently modified to provide for a depth of 12 feet, involving rock removal from the channel between the piers. In 1880 the project was expanded to provide an increase in channel depth to 14 feet from deep water in the lake to the city wharves. This project was never carried out. During the fiscal year ending June 30, 1881, a narrow cut 14 feet deep was dredged from the lake into the river except at two points where solid rock was encountered at 13 feet. The present ruling depth is 12 feet. Much the greater part of the superstructures of both piers is in a ruinous condition.

The accompanying report contains a project for the permanent repair of the piers and for the execution of a small amount of dredging, at an estimated total cost of $45,000. The estimated cost of the pier work is $42,350.

This harbor is of small commercial importance. In 1899 it was reported that "the harbor is not a commercial port, but is used somewhat as a refuge for small fishing boats and tugs." (Annual Report of the Chief of Engineers for 1899, page 529.) It appears from communications submitted by interested parties that the annual receipts by water amount to about 3,500 tons, consisting of fish (2,000 tons) and lumber (between 600,000 and 1,000,000 feet). There are no shipments by water. The existing depth serves present commerce reasonably well; this commerce is not sufficient to warrant any expenditure for deepening the entrance channel; nor would an increase of depth be followed by any material increase of commerce.

If the piers are not repaired in the immediate future they will be destroyed. To repair them with timber would be more expensive in the long run than the method proposed within. The district officer's plan provides for the permanent repair of the piers, and makes full use of their under-water portion, which portion is not subject to decay, and if protected from attack by the waves, is well suited to form part of a structure intended to be enduring. To provide permanently for the continuance of existing commerce, the Board believes that the piers should be repaired in the manner proposed by the district officer.

The Board is therefore of opinion that it is not desirable for the United States at the present time to do any further work in improvement of the entrance channel at Vermilion, but that it is desirable permanently to repair the piers, as proposed by the district officer, at a cost of $42,350.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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### LETTER OF MR. E. L. COEN.

VERMILION, OHIO, *September 4, 1902.*

DEAR SIR: Relative to the matter of the condition of our piers and harbor and the commerce of the port, I beg to submit the following:

For quite a number of years very little money has been expended for the maintenance of the channel and the piers and, consequently, their condition has grown steadily worse. The piers are fast going to ruin. The east one in particular has been broken through by the seas, about December 1, 1900, and again a few weeks ago. The former break was repaired temporarily, but its condition now is as bad as before the repairs were made.

Through the deposit of silt and the washing of sand into the channel through the break in the piers, the depth of water has been so reduced that it is now impossible for even the smaller of the lumber carriers to get in without lightering a portion of the cargoes. Even the deeper draft fishing tugs have recently been compelled to quit using this port because of the condition of the channel.

The same conditions have made it practically impossible for the excursion steamers to trade here, as they have previously done to some extent.

In spite of these hindrances to the commerce of the port a considerable amount of lumber has been received by boat, and the annual catch of fish here still amounts to about 4,500,000 or 5,000,000 pounds.

The port is also a harbor of refuge of considerable importance. It is frequented during the season by large numbers of yachts.

A large fleet of vessels, with an aggregate tonnage of probably 50,000, hails from this port, and a considerable amount of vessel repair work had always been done here during winters until the past few years, when the condition of the harbor prevented.

The citizens of Vermilion are deeply interested in the maintenance of the harbor, and trust that a sufficient appropriation will be made by Congress to at least restore it to its former condition.

Respectfully, yours,

E. L. Coen.

Maj. Dan C. Kingman,
*U. S. Engineer Corps.*

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### LETTER OF MR. ED. H. ZURHORST, COLLECTOR OF CUSTOMS.

Port of Sandusky, Ohio.
*September 3, 1902.*

Sir: I inclose a list of vessels in my district that hail from Vermilion, Ohio, and will say that from personal acquaintance and knowledge of the harbor of Vermilion, I am in hopes that you will carefully consider its situation, and aid, so far as you can consistently, in making much needed improvements, to the end that the harbor may be in condition to be of service to the vessel interests that would use it.

Respectfully, yours,

Ed. H. Zurhorst,
*Collector.*

Maj. Dan C. Kingman,
*Major, U. S. Engineer Corps.*

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*List of vessels hailing from the port of Vermilion, Ohio.*

Schooner Angus Smith.
Schooner B. W. Parker.
Schooner F. A. Georger.
Schooner Moonlight.
Schooner Melvin S. Bacon.
Schooner Verona.
Schooner W. S. Crosthwaite.
Steamer Alfred P. Wright.
Steamer Alex Nimick.
Steamer A. A. Parker.
Steamer Cumberland.
Steamer Columbia.
Steamer C. W. Elphicke.
Steamer City of Naples.
Steamer City of Genoa.
Steamer City of Rome.
Steamer Charles P. Stricker.
Steamer Charlemagne Tower, jr.
Steamer Charles A. Eddy.
Steamer Favorite.
Steamer George F. Williams.
Steamer Hiawatha.
Steamer Helena.
Steamer John Craig.
Steamer J. C. Gilchrist.
Steamer John Harper.
Steamer Lansing.
Steamer Merrimac.
Steamer Manhattan.
Steamer Massachusetts.
Steamer Markwell.
Steamer Mecosta.
Steamer Neosho.
Steamer Neshoto.
Steamer Olympia.
Steamer R. E. Schuck.
Steamer Sitka.
Steamer Tacoma.
Steamer V. Swain.
Steamer Waverly.
Steamer Wallula.
Steamer Yukon.
Steamer Yakima.
Steamer Gilchrist.
Steamer Lake Shore.

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### LETTER OF THE GEO. FISCHER LUMBER COMPANY.

Vermilion, Ohio, *September 4, 1902.*

Dear Sir: We understand you are preparing a report of the condition of Vermilion Harbor, and that you have recently been here to inspect for this purpose; if this is correct you undoubtedly know the necessity for improvements to save the harbor.

The extent of our business at this place depends very largely upon the condition of the harbor, in the way of getting our lumber supply, and also in trade that we get through the fishing interests, which are quite extensive here, and unless the harbor can be maintained and improved we will all suffer loss and finally be obliged to quit business, which will be a great loss to the village.

We receive here annually by water from 600,000 feet to 1,000,000 feet of lumber. If the harbor was deeper we would increase this very largely, because we now are often compelled to resort to rail shipment for supply on account of not being able to obtain boats that can get in here.

We hope that you will report as favorably as possible, and that you can recommend an appropriation for the betterment of the harbor; the latter is what we need.

Yours, very truly,

THE GEO. FISCHER LUMBER CO.,
GEO. FISCHER.

DAN C. KINGMAN,
*Major, Corps of Engineers, U. S. A.*

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LETTER OF AGENT OF LAKE SHORE AND MICHIGAN SOUTHERN RAILWAY COMPANY.

THE LAKE SHORE AND MICHIGAN SOUTHERN RAILWAY COMPANY,
*Vermilion, Ohio, September 3, 1902.*

DEAR SIR: Agreeably to request, for the year ending August 30, 1902, forwarded 3,100,000 pounds of fish from this station.

In looking over the figures for the past ten years I find the average shipment of fish has been 3,800,000 pounds per year.

Yours, truly,

A. H. LEIMBACH, *Agent.*

Mr. E. L. COEN, Esq.,
*Cashier Erie County Banking Company, Vermilion, Ohio.*

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## SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION.

ENGINEER OFFICE, U. S. ARMY,
*Cleveland, Ohio, August 26, 1903.*

GENERAL: When I submitted my report of my preliminary examination of the harbor of Vermilion, Ohio, an allotment was made of $250 by the Chief of Engineers to enable me to extend the preliminary examination, by survey or otherwise, as far as might be necessary to enable me to offer an opinion as to the worthiness of the improvement. The examination has accordingly been extended, and the information gained is exhibited upon a map,[a] a tracing of which is transmitted herewith. This shows the exact condition of the channel at the present time and also the condition of the piers. The superstructure of the piers is in a ruinous state. The timber is nearly all decayed, the sea breaks over them, and the sand is carried into the channel. They will deteriorate rapidly from this time and it will not be very long before they will be breached and the channel so filled up as to render the harbor entirely useless.

The United States has expended at this place the sum of $133,277.55 during the entire period in which the harbor has been under improvement. The tracing shows the net result of the expenditure. If nothing is done in a few years the entire expenditure will be lost. By the expenditure of an additional amount the piers may be restored, rendered durable, and the harbor may be made as good as it ever was. It is of some value locally and of some value as a refuge for small vessels. It may become more valuable in the future.

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[a] Not printed.

There is shown upon the tracing a section of jetty showing how it might be repaired. The superstructure is first cut down to mean lake level, which is about the line of no decay for timber. The walls of the crib are then reenforced by a riprap of heavy stone having slopes of 1 on 1½. The new superstructure is built by rounding up the stone filling of the crib and paving with large flat stone not less than 2½ feet thick, so as to give a form of superstructure as indicated, and a height of jetty about 5 feet above mean level.

For the execution of the work it would require the following material:

| | |
|---|---|
| 9,500 tons of paving, at $2 a ton | $19,000 |
| 13,000 tons of heavy riprap, at $1.50 a ton | 19,500 |
| To restore the channel there will be about 12,000 yards of dredging, at 20 cents a yard | 2,400 |
| In all | 40,900 |

or, with the addition of about 10 per cent for contingencies, the cost, in round numbers, would be $45,000.

This is about 33 per cent of the amount already invested at this harbor, and in my opinion this expenditure would be judicious. I think this treatment is the proper one to apply to the small jettied harbors on the chain of lakes.

I am therefore of the opinion that the harbor is worthy of improvement to this extent, and I am of the opinion that the whole or any portion of this amount, not less than one-fourth, could be advantageously expended in the next fiscal year.

Very respectfully, your obedient servant,

Dan C. Kingman,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

Office Division Engineer, Northwest Division,
*Chicago, Ill., September 8, 1903.*

Respectfully forwarded to the Chief of Engineers, recommended for approval.

O. H. Ernst,
*Colonel, Corps of Engineers,*
*Division Engineer, Northwest Division.*

# APPENDIX Q Q.

## IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA, AND OF CERTAIN RIVERS AND HARBORS IN WESTERN NEW YORK.

*REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. THEO. A. BINGHAM AND FIRST LIEUT. P. S. BOND, CORPS OF ENGINEERS.*

### IMPROVEMENTS.

1. Erie Harbor, Pennsylvania.
2. Dunkirk Harbor, New York.
3. Buffalo Harbor, New York.
4. Lake Erie entrance to Black Rock Harbor and Erie Basin, New York.
5. Buffalo entrance to Erie Basin and Black Rock Harbor, New York.
6. Tonawanda Harbor and Niagara River, New York.

### EXAMINATIONS AND SURVEYS.

7. Black Rock Harbor, New York.
8. Erie Basin, Buffalo Harbor, New York.

### HARBOR LINES.

9. Buffalo Harbor, New York, at Stony Point.

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United States Engineer Office,
*Buffalo, N. Y., July 18, 1904.*

General: I have the honor to forward herewith reports of operations on the river and harbor works under my charge for the year ending June 30, 1904.

Very respectfully, your obedient servant,

P. S. Bond,
*First Lieut., Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

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## Q Q 1.

## IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA.

### REPORT OF OPERATIONS.

All work, except minor repair work, was done under contract with the Buffalo Dredging Company, Buffalo, N. Y., dated August 29, 1902.

*Concrete superstructure, south pier.*—This work implied the removal of the decayed timber superstructure and stone filling from the whole pier, 1,215 feet long, to the elevation of 2 and 3 feet below mean water level in different portions of the work, as defined in the specifications; the leveling and repair of the cribs to a true grade at these elevations; the placement of concrete blocks of the dimensions specified, backed with stone filling and the molding in place of a concrete deck, covering the blocks and stone filling. The crown of the finished superstructure to be 4 feet above mean lake level.

The following was the condition of the work at the beginning of the fiscal year:

The superstructure and crib walls above grade had been removed for a distance of 421.7 feet from the east end; 210 feet, seven crib lengths, from the east end had been leveled and repaired for the reception of concrete blocks; thirty-one side wall blocks had been placed in position and two cross-wall blocks molded in place; the flagstones mentioned in paragraphs 84 and 85 of the specifications had been removed to the south breakwater and deposited in the deck of that structure for a distance of 571 feet from the north end.

Operations involving the removal of old superstructure, leveling and repairing cribs, making and setting concrete blocks, placing stone filling between blocks, and molding in place the concrete deck, were continued in proper correlation during the fiscal year, until the work was finally completed on November 4, 1903. The reconstruction has placed the south pier in a permanent form, neat and substantial in appearance.

The repair of the underlying cribs over the easterly 424 linear feet of the pier presented no unusual features and was accomplished under the ordinary methods.

The cribs in the remaining 791 linear feet of the work, however, were sunk in irregular alignment and surface and were built of round timber flattened on two sides and fastened with tree-nails. This substructure had endured since the early dates of the improvement at this harbor and the cribs were well founded. It was therefore decided to build back the specified new timber grillage foundation on the old timber wherever found, examining the work critically to develop any weakness requiring special repair.

The old cribs over this portion of the work were removed to depths varying between 2.75 feet and 6 feet below mean lake level; and the work repaired and built back with hemlock timber to the uniform elevation of 2 feet below mean lake level as a foundation for the concrete blocks.

All crib timbers were lacking at four locations in the harbor face. The aggregate length of the openings being, approximately, 80 feet. The openings were closed with 15 oak piles, 20 feet long, driven in the channel face about 5 feet centers and capped with the face timber of the grillage support for the concrete blocks. All crib timbers were lacking for 92 linear feet at the west end of the structure. The substructure here consisting of a mound of rubble stone, of indeterminate depth, held in position at the sides by piles driven about 4 feet centers.

The adjacent lake and channel beds were above the elevation fixed for the bottom of the concrete blocks, and the stability of the rubble was, in all respects, ample for the requirements of the foundation.

The lines of the new superstructure here were established and the sections of the foundation grillage assembled, sunk, and bedded in prepared and leveled trenches in the rubble stone of the structure.

The construction and methods employed in the repair of the underlying cribs were recorded on a drawing of the work, compiled from day to day, as the work progressed.

The removal of the old superstructure was begun on April 20 and the repair of cribs on May 5, 1903. Both were completed on practically the same date—October 14, 1903.

All operations incident to the preparation of the foundation cribs were carried on in water from 2 to 6 feet deep, necessitating special examination of the underlying cribs to determine their condition.

A water telescope 6 feet long was designed to facilitate this examination. It was in the form of a conical shell, of galvanized iron, No. 16 gauge, 6 inches diameter at the bottom and 2 inches at the top. A plate glass one-fourth of an inch thick was fitted in the bottom and secured by galvanized iron lugs against which the glass was "bedded" in steamfitters' cement. This appliance enabled the force to control and critically examine all details of the work from the water surface.

At the beginning of the fiscal year the molding of concrete blocks was well advanced. Operations, in this particular, were continued from time to time, in connection with the other items of the work, to completion on October 8, 1903. The placement of the concrete blocks had been begun during June, 1903. During the fiscal year this work was advanced, at intervals, to a completion October 19, 1903, on which date the closure blocks were set.

The progress of this portion of the work developed no unusual conditions and no special construction was employed worthy of mention, except that the back of the blocks were in all cases founded on supporting timbers of the grillage.

The deck concrete was laid in 24 sections in lengths varying from 40 to 60 feet and in widths varying from 18 to 11½ feet, conforming to the span over the concrete blocks. This item of the work was begun on July 23 and completed on October 31, 1903.

The placement of manhole covers was carried on at intervals between October 9 and November 2, 1903.

The work was cleaned up and accepted on November 4, 1903. The plan and methods of construction for the south pier concrete superstructure were in all respects similar to those employed on the concrete superstructure for the north pier in 1899-1900. This work is described and illustrated by photographs in the Annual Report of the Chief of Engineers for 1900, page 4102 et seq.

The concrete entering into this work was composed of Lehigh Portland cement, beach sand from local beaches, gravel from Niagara River, New York, and crushed flinty limestone, the full product of the crusher being incorporated. All concrete was made in proportions of 1 part cement, 2 parts sand, 2 parts gravel, and 4 parts broken stone. All concrete was mixed in a 4-foot cube mixer. The volume of water added in mixture was under definite regulation and was varied between the extremes of 3 and 8 per cent of the volume of the batch, depending on the degree of saturation of the components due to the weather conditions. The concrete was mixed wet to the intent of supplying a thoroughly plastic mass.

The care of public property, the surveillance of the peninsula, and the water-level observations with the automatic water gauge were continued during the year.

*Surveillance of Presque Isle Peninsula.*—Watchman James Hunter was on duty throughout the year to see that no depredations were committed and to put out fires which occasionally occur. In addition to these duties he acted as engineer of the steam launch during the season of navigation, and had charge of the water gauge.

A history of attempts during past years to secure for private or corporate interests the right to use or title to the peninsula is given in the Annual Reports of the Chief of Engineers for 1898, pages 2743 et seq.; for 1901, pages 3298 et seq., and for 1903, 2117 et seq.

During the past fiscal year the water commissioners of the city of Erie, Pa., occupied the portion of the peninsula at "Big Bend" with survey parties, and, in connection with their surveys for waterworks purposes, built two board buildings and a small wharf on the bay shore, and cut out underbrush, and planted monuments. While specific authority for such occupancy was doubtful, it was not interfered with, as none of the occupancy was in material conflict with the rights and interests upon the peninsula.

The following act was passed by the Fifty-eighth Congress, second session:

AN ACT Granting certain rights and privileges to the commissioners of waterworks in the city of Erie, Pennsylvania.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the commissioners of waterworks in the city of Erie, State of Pennsylvania, are hereby granted the right to use and occupy so much of the land belonging to the United States, known as Presque Isle Peninsula, not exceeding one hundred and seventy-five acres, as may be necessary for the purpose of laying, extending, protecting, and maintaining an intake pipe, and for laying out, installing, building, maintaining, and operating the necessary reservoirs, settling basins, and filtration beds for the waterworks of the said city of Erie, and in connection therewith to construct and maintain buildings, houses, and sheds, to reclaim marsh lands, to plant trees and shrubs, to build and maintain walks, roads, docks, and any other works, improvements, or structures that may be required for the purpose of supplying the city of Erie with water, and for no other purpose: *Provided*, That the use and occupation of the said lands shall in no manner affect the right, title, and interest of the United States in and to such land, nor the Government right of passage across the land so occupied; and the said commissioners of waterworks shall do nothing that may injuriously affect the harbor of Erie or the peninsula of Presque Isle as a protection for this harbor: *Provided further*, That the United States shall not be liable for any damage whatever that may at any time occur to the waterworks improvement: *And provided further*, That the exercise of the right hereby granted, and the execution of any work hereby authorized, shall be in accordance with such plans and specifications as may be approved by the Secretary of War, and subject to such further stipulations and conditions as he may prescribe.

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, April 27, 1904.

Under the provisions of this act and of the act of February 23, 1893, chapter 153, ample rights and privileges are secured to the water commissioners of the city of Erie to extend and perfect the water supply of their city.

### CONDITION OF THE WORKS.

The north pier is in good condition, except 750 linear feet of timber crib pier, which was built prior to 1883. This portion is badly decayed, and the reconstruction of the superstructure with concrete is urgent.

The reconstruction and repair of the south pier and south breakwater in 1903 has placed these structures in good condition.

The entrance channel and harbor basin are in good condition. The channel is practically of the required depth of 20 feet at mean lake level for the required width of 300 feet.

The preservation of the peninsula is of vital importance to Erie Harbor, and it is for the purpose of preserving the harbor that the protection of the weak parts of the peninsula has been deemed necessary. The weakest portion is the long narrow neck at the western end, and works of protection have been constructed to prevent a breach through this narrow neck. The danger exists during severe storms from the westward.

The protection works for the neck consist of the remains of a shore protection constructed in 1889, which afford little or no protection, and the tree growth propagated and maintained on the neck. During 1896-1898 about 6,600 young locust and willow trees were planted on the neck of the peninsula. Most of these have grown finely and now furnish a permanent and living protection to this neck.

The beach erosion along the body of the peninsula has been corrected to some extent by jetties built out from the shore. At the present time there is one dilapidated jetty at the easterly end no longer of service, and three jetties about the middle of the peninsula shore.

### PROPOSED OPERATIONS AND REMARKS.

The river and harbor act of March 3, 1899, officially adopts a new and extended project for the improvement of Erie Harbor. This is in accordance with the report from this office, with map, in House Executive Document No. 70, Fifty-fifth Congress, first session, and without map in the Report of the Chief of Engineers for 1897, page 3238. This new project is summarized as follows:

(1) To repair and keep in repair existing structures.

(2) To extend the north pier 500 feet.

(3) To extend the south pier 1,000 feet.

(4) To dredge the entrance channel to a depth of 20 feet.

(5) To dredge a portion of the eastern end of the bay, needed for access to docks, to a depth of 20 feet.

(6) To build four protection jetties along the outside of Presque Isle Peninsula.

(7) To maintain existing structures on, and care for Presque Isle Peninsula.

The estimated cost of the project is $377,000, which, however, does not include items 1 and 7, except as specially estimated for at the time the project was adopted.

It is estimated that $127,000 can be profitably expended during the next fiscal year in carrying on work under the project, viz, to extend the south pier 1,000 feet, to build one protection jetty on the outside of Presque Isle Peninsula, and to complete the dredging of the harbor basin under the project.

There will be required in addition the sum of $50,000 for new superstructure on the 750 feet of badly decayed pier and $10,000 for general maintenance, total, $60,000; making the total amount that should be appropriated $187,000.

The business of Erie Harbor is increasing, and this is believed to be largely due to the bettered conditions of the harbor and entrance. The further work covered by the existing project at Erie should be carried on with as little delay as practicable.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $89,616.84 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $9,415.13 | |
| For maintenance of improvement | 51,979.25 | |
| | | 61,394.38 |
| July 1, 1904, balance unexpended | | 28,222.46 |
| Amount (estimated) required for completion of existing project | | 127,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $127,000.00 | |
| For maintenance of improvement | 60,000.00 | |
| | | 187,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### STATEMENT OF APPROPRIATIONS AND ALLOTMENTS.

| | | | |
|---|---|---|---|
| 1823 | $150.00 | March 3, 1871 | $29,000.00 |
| May 26, 1824 | 20,000.00 | 1871 (allotment) | 10,000.00 |
| May 25, 1826 | 7,000.00 | June 10, 1872 | 15,000.00 |
| March 2, 1827 | 2,000.00 | June 23, 1874 | 20,000.00 |
| May 19, 1828 | 6,223.18 | March 3, 1875 | 80,000.00 |
| March 3, 1829 | 7,390.25 | August 14, 1876 | 40,000.00 |
| March 2, 1831 | 1,700.00 | June 16, 1878 | 25,000.00 |
| July 3, 1832 | 4,500.00 | March 3, 1879 | 25,000.00 |
| March 2, 1833 | 6,000.00 | June 14, 1880 | 25,000.00 |
| June 28, 1834 | 23,045.00 | March 3, 1881 | 20,000.00 |
| March 3, 1835 | 5,000.00 | August 2, 1882 | 20,000.00 |
| July 2, 1836 | 15,122.80 | July 5, 1884 | 50,000.00 |
| March 3, 1837 | 15,000.00 | August 5, 1886 | 37,500.00 |
| July 7, 1838 | 30,000.00 | August 11, 1888 | 83,000.00 |
| June 11, 1844 | 40,000.00 | September 19, 1890 | 40,000.00 |
| August 30, 1852 | 30,000.00 | 1891 (received from sales) | 4,716.89 |
| 1864 (allotment) | 15,000.00 | July 13, 1892 | 40,000.00 |
| June 23, 1866 | 36,961.00 | August 18, 1894 | 10,000.00 |
| March 2, 1867 | 25,000.00 | March 3, 1899 | 125,000.00 |
| 1868 (allotment) | 40,000.00 | June 13, 1902 | 125,000.00 |
| 1869 (allotment) | 22,275.00 | | |
| June 11, 1870 | 20,000.00 | Total | 1,196,584.12 |

### COMMERCIAL STATISTICS OF ERIE HARBOR, PENNSYLVANIA.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 1,040 | 1,610,246 | 48 | 34,249 | 1,081 | 1,654,685 | 37 | 23,541 |
| Sail and barges | 104 | 83,258 | 18 | 7,405 | 77 | 83,321 | 18 | 6,923 |
| Total | 1,144 | 1,693,504 | 66 | 41,654 | 1,158 | 1,738,006 | 55 | 30,464 |

Total arrivals and departures—Number, 2,423; tonnage, 3,503,628.
Decrease of tonnage, 1903 under 1902, 370,106 tons.
Amount of revenue collected, year 1903, lake commerce, $10,805.26.
Value of imports—lake, $98,424; rail, $191,754.
Value of exports—lake, $83,420; rail, none.
Enrolled tonnage, port of Erie, Pa., 37,177 net tons.
Greatest draft of vessels, 19 feet.

*Receipts and shipments by lake.*

RECEIPTS.

[Tons of 2,000 pounds.]

| | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|
| Merchandise | 95,661 | 123,262 | 40,876 | 42,020 | 78,342 | 89,141 |
| Barley | 9,223 | 2,119 | | 225 | 2,277 | 6,863 |
| Corn | 288,400 | 147,831 | 235,940 | 840 | 841 | 95,849 |
| Oats | 5,916 | 2,575 | | | | |
| Rye | 57,881 | 10,417 | | | | 10,283 |
| Wheat | 94,862 | 15,237 | 39,521 | 50,146 | 44,162 | 33,588 |
| Flaxseed | 2,224 | 23,475 | 9,622 | 9,785 | | |
| Flour | 154,614 | 192,824 | 104,757 | 118,776 | 180,982 | 166,631 |
| Lumber | 7,544 | 13,589 | 14,306 | 15,740 | 28,085 | 17,903 |
| Laths | | 63 | | 225 | 77 | 115 |
| Poles and stave bolts | | 520 | | | | 12 |
| Ties | | | | | | 732 |
| Iron ore | 1,221,483 | 1,467,204 | 1,670,465 | 1,518,099 | 1,934,983 | 1,257,798 |
| Copper | 26,571 | 29,241 | 16,267 | 18,104 | 5,465 | 12,975 |
| Lead | 948 | 8,865 | 508 | 1,170 | 2,239 | 2,973 |
| Limestone | | 26,812 | | | | 2,700 |
| Plaster and cement | | 700 | | | | |
| Fish | | | | 8,300 | | 3,800 |
| Pulp wood | | 14,684 | 40,431 | 22,618 | 82,400 | 16,938 |
| Total | 1,965,330 | 2,073,868 | 2,172,193 | 1,806,048 | 2,304,803 | 1,718,301 |

SHIPMENTS.

| | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|
| Anthracite coal | 612,282 | 787,719 | 725,101 | 519,974 | 154,482 | 291,642 |
| Bituminous coal | 357,870 | 537,600 | 405,741 | 530,738 | 660,202 | 533,586 |
| Pig and manufactured iron | 626 | 113 | 416 | 38 | 1,079 | 642 |
| Merchandise | 125,218 | 137,171 | 53,905 | 59,475 | 105,447 | 118,788 |
| Total | 1,095,996 | 1,412,603 | 1,185,163 | 1,110,225 | 921,160 | 944,658 |

## Q Q 2.

## IMPROVEMENT OF HARBOR AT DUNKIRK, NEW YORK.

### REPORT OF OPERATIONS.

No work was done upon any of the harbor structures nor was any dredging done in the channels during the fiscal year.

### CONDITION OF THE WORKS.

The west pier is in good condition, except two old timber sections, one 110 feet long and one 266 feet long, which are in need of new concrete superstructure. When this new superstructure is supplied the whole pier will be completed in a permanent concrete form.

The breakwater is intact, but the old part, 1,341 feet long, is much decayed, and further patching up of the old timber superstructure is not effective or advisable. It should be replaced by concrete in the near future.

### PROPOSED OPERATIONS AND REMARKS.

The work outlined in the adopted project for Dunkirk Harbor has been completed and the harbor is ready for use. Experience has demonstrated that the addition of an easterly breakwater is necessary to properly protect the harbor, and a report with estimates of the cost of the requisite structure was submitted and published in House Document No. 74, Fifty-sixth Congress, first session.

All of the timber portion of the main breakwater built prior to 1880, 1,341 linear feet, is old and much decayed and liable to be seriously damaged by seas, necessitating extensive repairs. The remaining timber portions of the west pier, viz, two sections, one 110 feet long and one 266 feet long at the outer end, are also old and much decayed and liable to similar damage.

The thorough repair of these structures can only be effected by rebuilding the superstructures in concrete, and this plan has been followed out so far as funds would permit during the past six years.

The repair work on the west pier substructure, closing the breaches therein, was done with a view to preparing the substructure to receive a new concrete superstructure. This concrete work could not be done until the new repair cribs had fully settled upon their foundations. Such final settlement has now occurred, but the available funds are not sufficient for replacing the 376 linear feet of old timber work with a concrete superstructure, which is estimated to cost $25,000, including contingencies and engineering expenses.

Moreover, the pier work could be most advantageously done in connection with at least as much again of concrete work on the breakwater, or under a contract of not less than $50,000. It is therefore estimated that the next river and harbor bill should appropriate $35,000, to be used in connection with the funds available for completing the concrete superstructure on the west pier, which is estimated to cost $25,000; for rebuilding with concrete 500 linear feet of decayed superstructure on the breakwater, which is estimated to cost $25,000, including contingencies, and for general maintenance of structures and channels, which is estimated at $7,000, including contingencies.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $22,032.03 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 2.65 |
| July 1, 1904, balance unexpended | 22,029.38 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 35,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

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#### STATEMENT OF APPROPRIATIONS AND ALLOTMENTS.

| | | | |
|---|---|---|---|
| March 27, 1827 | $3,000.00 | March 3, 1873 | $48,132.95 |
| May 19, 1828 | 6,000.00 | June 23, 1874 | 35,000.00 |
| March 3, 1829 | 9,812.75 | March 3, 1875 | 35,000.00 |
| April 23, 1830 | 1,342.75 | August 14, 1876 | 18,000.00 |
| March 2, 1831 | 7,102.50 | 1879 | 2,500.00 |
| July 3, 1832 | 10,200.00 | June 14, 1880 | 10,000.00 |
| June 28, 1834 | 4,000.00 | July 5, 1884 | 10,000.00 |
| March 3, 1835 | 10,988.43 | August 5, 1886 | 20,000.00 |
| July 2, 1836 | 11,000.00 | August 11, 1888 | 15,000.00 |
| March 3, 1837 | 15,000.00 | September 19, 1890 | 20,000.00 |
| July 7, 1838 | 10,000.00 | July 13, 1892 | 20,000.00 |
| June 11, 1844 | 5,000.00 | August 18, 1894 | 20,000.00 |
| August 30, 1852 | 30,000.00 | June 3, 1896 | 10,000.00 |
| March 2, 1867 | 100,000.00 | June 22, 1896 (repayment) | 250.00 |
| 1869 | 2,000.00 | June 4, 1897 | 398,258.00 |
| July 11, 1870 | 25,000.00 | June 13, 1902 | 25,000.00 |
| March 3, 1871 | 25,000.00 | | |
| June 10, 1872 | 25,000.00 | Total | 987,587.38 |

### COMMERCIAL STATISTICS OF DUNKIRK HARBOR, NEW YORK.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 107 | 26,854 | 17 | 5,537 | 96 | 26,875 | 17 | 5,537 |
| Sail and barge | ..... | ........ | ..... | ........ | ..... | ........ | ..... | ........ |
| Total | 107 | 26,854 | 17 | 5,537 | 96 | 26,875 | 17 | 5,537 |

Total arrivals and departures: 237; tonnage, 64,803.
Increase of tonnage, 1903 over 1902, 31,368 tons.
Amount of revenue collected for the year 1903: Lake, $113; rail, $2,133.62.
Value of imports: Lake, $2,366; rail, $12,174.
Value of exports: None.
Receipts by lake: Lumber, 1,257 tons.
Shipments by lake: Fish, 94 tons.
Passengers entered and departed, about 13,000.
Enrolled tonnage, port of Dunkirk, N. Y., 673 gross tons.
Greatest draft of vessels, 16 feet.

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## Q Q 3.

## IMPROVEMENT OF BUFFALO HARBOR, NEW YORK.

### REPORT OF OPERATIONS.

The following is a detailed report of the operations on the different works during the fiscal year:

### EXTENSION OF BREAKWATER TO STONY POINT.

*Rubble Mound, or Stone Breakwater.*—At the beginning of the fiscal year, July 1, 1903, work was in progress under the contracts in force. This work was the restoration of the superstructure of the settled portion of the stone breakwater. (See Report of the Chief of Engineers for 1903, p. 2127.) The total expenditure at this date was $931,275.94.

The prevailing wind during July was from the west and about equally divided between light and brisk. During the month 320 blocks of the recovered capping stone from the sunken breakwater were reset and 732 blocks, or 4,655.6 tons, of new capping stone and 6,936.3 tons of rubblestone were placed in the work.

Good weather generally prevailed during the month of August, there being a few days more of westerly than easterly winds; the former ranged from light to brisk, while the latter were light. During the month 257 blocks of recovered capping stone were reset and 903 blocks, or 5,915.1 tons of new capping stone and 4,613.9 tons of rubblestone were placed in the work.

The weather during September was quite favorable, westerly winds predominating. Three hundred and sixty-five blocks of recovered capping stone were reset and 478 blocks, or 2,563.8 tons of new capping stone and 2,611.6 tons of rubblestone were placed in the work. The last capping stone was set in place in the stone-breakwater section on September 24, 1903, finally completing the reconstruction.

The reconstruction of the superstructure was accomplished on the exact lines of the original structure, but the slipped material under water along the harbor base of the structure was not disturbed.

As stated in the last annual report, work on the reconstruction was begun on April 23, 1903, recovering the sunken capping stones by means of a diver. This work was practically completed on June 30; some few stones were recovered during July and August. Most of the recovered stone was stored on the uncompleted part of the breakwater and used as needed. Altogether, 1,790 blocks, representing over 11,000 tons, were recovered and reset in the work. The methods employed in the work of reconstruction were similar to those on the original work, all capping stone being set by floating derricks.

In addition to the work of reconstruction much of the harbor side of the section rebuilt was reenforced by the dumping of rubblestone on top of the slopes and along the base below water level.

A typical section of the breakwater as rebuilt and reenforced is shown on the accompanying drawing, which is a cross section at station 64+20.

The cost of the reconstruction of the settled portion of the stone breakwater, 1,300 feet long, was as follows:

| | |
|---|---|
| 27,634.3 tons of rubblestone from Canada, at 80 cents | $22, 107. 44 |
| 15,338.2 tons of capping stone from Canada, at $1.25 | 19, 172. 75 |
| Force account work, including 15 per cent | 15, 583. 03 |
| Cost | 56, 863. 22 |

Other portions of the stone breakwater were also strengthened by dumping rock on the harbor-side slope under water. This rock was obtained from channel excavations on the improvement of the Lake Erie entrance to Black Rock Harbor and Erie Basin, New York, and was placed without cost to the Government.

The final construction of portions of breakwater thus reenforced is shown on two accompanying drawings, which are typical cross sections of structure.

The following is a statement of the detailed cost of the stone breakwater as finally completed:

| | |
|---|---|
| Original contract of January 27-28, 1897: | |
| 245,242 cubic yards gravel, at 13 cents | $31, 881. 46 |
| 202,969.3 tons rubblestone from United States, at 80 cents | 162, 375. 44 |
| 317,606. 9 tons rubblestone from Canada, at 80 cents | 254, 085. 05 |
| Supplemental contract, April 26, 1898: | |
| 129,921.9 tons rubblestone from Canada, at 75 cents | 97, 441. 43 |
| Supplemental contract, September 4, 1902: | |
| 422.1 tons rubblestone from United States, at 77½ cents | 327. 13 |
| 16,315.5 tons rubblestone from Canada, at 77½ cents | 12, 644. 51 |
| 563.5 tons rubblestone from Canada, at 72½ cents | 408. 54 |
| Supplemental contract, December 31, 1902: | |
| 27,634.3 tons rubblestone from Canada, at 80 cents | 22, 107. 44 |
| Original contract, January 27-28, 1897: | |
| 142,429.1 tons capping stone from Canada, at $1.25 | 178, 036. 38 |
| Supplemental contract, April 26, 1898: | |
| 142,449.4 tons capping stone from Canada, at $1.20 | 170, 939. 28 |
| Supplemental contract, December 31, 1902: | |
| 338.2 tons capping stone from Canada, at $1.25 | 19, 172. 75 |
| tal contract, December 31, 1902: | |
| and replacing 11,000 tons capping stone, force account | 15,583. 03 |
| | 965, 002. 91 |
| arts of cents, account of monthly payments | . 08 |
| | 965, 002. 99 |

# BUFFALO HARBOR, N. Y.

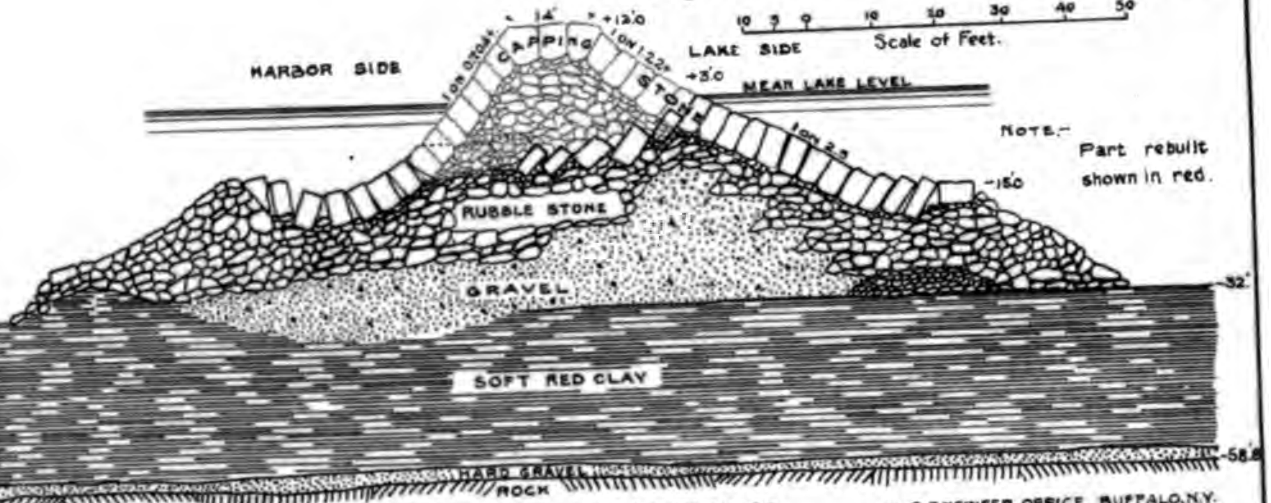
## BREAKWATER EXTENSION TO STONY POINT.

## TYPICAL SECTION OF STONE BREAKWATER.

WHERE IT SETTLED AND WAS REBUILT.

To accompany annual report for 1904

of Major Theo. A. Bingham, Corps of Engineers, U. S. Army.



NOTE.– Part rebuilt shown in red.

CROSS SECTION AT STATION 64+20

J. C. QUINTUS, PRIN. ASST. ENG'R.
EMILE LOW, ASST. ENG'R.
LYNN L. DAVIS, JUN. ENG'R.

U. S. ENGINEER OFFICE, BUFFALO, N.Y.
APRIL, 1904.

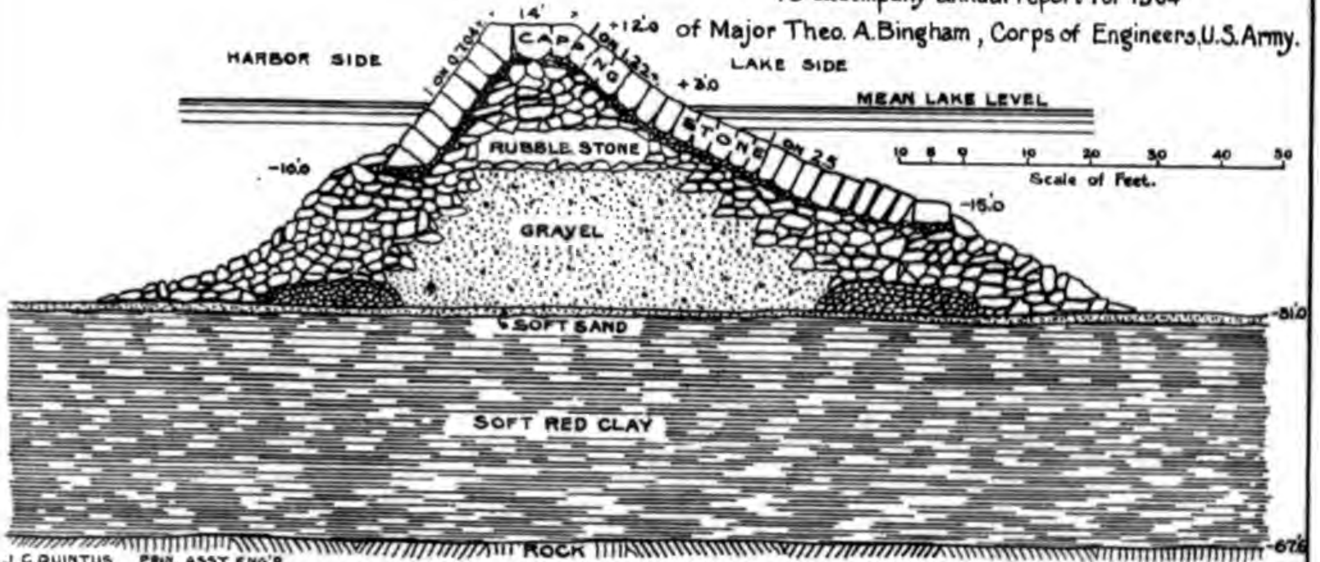
Eng 58 3

# BUFFALO HARBOR, N.Y.

## BREAKWATER EXTENSION TO STONY POINT.

## TYPICAL SECTION OF STONE BREAKWATER.

To accompany annual report for 1904
of Major Theo. A. Bingham, Corps of Engineers, U.S. Army.



CROSS SECTION AT STATION 57+30

J. C. QUINTUS. PRIN. ASST ENG'R.
EMILE LOW ASST ENG'R.
LYNN L. DAVIS, JUN. ENG'R.

U.S. ENGINEER OFFICE, BUFFALO, N.Y.
APRIL, 1904.

Eng 58 3

*Stony Point section, timber-crib breakwater.*—This section of the breakwater was fully completed in 1901, and no work was done upon it during the past fiscal year.

The cost of this section of the breakwater, exclusive of engineering and office expenses, was as follows:

| | | |
|---|---|---|
| 206,861 cubic yards trench excavation, at 18 cents | $37,234.98 | |
| 193,383 cubic yards trench filling, at 13 cents | 25,139.79 | |
| | | $62,374.77 |
| Foundation stone: | | |
| 12,605.2 tons from United States, at 80 cents | 10,084.16 | |
| 6,363.1 tons from Canada, at 75 cents | 4,772.33 | |
| Rubble wall stone: | | |
| 202.5 tons, at 80 cents | 162.00 | |
| Total, 19,170.8 tons | | 15,018.49 |
| Timber crib work: | | |
| 300 linear feet, at $14.41 | 4,323.00 | |
| 120.5 linear feet, at $19.65 | 2,367.83 | |
| 360.8 linear feet, at $41.27 | 14,890.22 | |
| 541.1 linear feet, at $67.48 | 36,513.43 | |
| 1,504.5 linear feet, at $92.37 | 138,970.67 | |
| | 197,065.15 | |
| Deduct 40,454.2 tons filling stone from Canada, at 5 cents | 2,022.71 | |
| | | 195,042.44 |
| 14 mooring cleats, at $6 | | 84.00 |
| 10 mooring posts, at $36 | | 360.00 |
| Extra work at north end, emplacement for light-house | | 725.96 |
| | | 273,605.66 |
| Repairing damage in 1901 | | 3,819.46 |
| Total | | 277,425.12 |

*Cost of the extension of the Buffalo breakwater to Stony Point.*—The following summary of cost is derived from the foregoing tables of cost:

| | |
|---|---|
| Stone breakwater | $965,002.99 |
| South Harbor section, timber-crib-concrete breakwater | 681,445.37 |
| Stony Point section, timber-crib breakwater | 277,425.12 |
| Total | 1,923,873.48 |

The cost per linear foot of the different structures is as follows:

| | Per lin. ft. |
|---|---|
| Stone breakwater, 7,250 feet long | $133.10 |
| South Harbor breakwater (timber-crib-concrete) 2,739 feet long | 248.79 |
| Stony Point breakwater, 2,802.9 feet long | 98.97 |

*Windmill Point, Ontario, Quarry.*—All the stone deposited in the breakwater construction by contract during the fiscal year was obtained from the Canadian quarry of the contractors Hughes Bros. & Bangs, located at Windmill Point, Ontario. The output of this quarry from the inception of the work in 1897 to the final completion in 1903, was as given in the following table, in tons of 2,000 pounds:

| Season of— | Rubble stone, tons of 2,000 pounds, used in the construction of— | | | Total. | Capping stone used in stone breakwater. | Total. |
|---|---|---|---|---|---|---|
| | Stone breakwater. | Stony Point section. | South Harbor section. | | | |
| 1897 | 27,501.5 | | | 27,501.5 | 383.4 | 27,884.9 |
| 1898 | 66,680.9 | 30,588.8 | | 97,269.7 | 16,078.7 | 113,348.4 |
| 1899 | 26,351.1 | 16,228.5 | 68,977.8 | 111,557.4 | 42,425.1 | 153,982.5 |
| 1900 | 79,685.0 | | 43,261.0 | 122,946.0 | 54,988.7 | 177,934.7 |
| 1901 | 145,813.5 | | 21,981.6 | 167,795.1 | 77,531.7 | 245,326.8 |
| 1902 | 118,375.8 | | 18,903.4 | 137,279.2 | 93,470.9 | 230,750.1 |
| 1903 | 27,634.3 | | 30,865.3 | 58,499.6 | 15,338.2 | 73,837.8 |
| Total | 492,042.10 | 46,817.3 | 183,989.1 | 722,848.5 | 300,216.7 | 1,023,065.2 |

In addition, a large amount of stone was also obtained in the United States, as shown in the following table:

| Season of— | Rubble stone, tons of 2,000 pounds, used in the construction of— | | | Total. | Remarks. |
|---|---|---|---|---|---|
| | Stone breakwater. | Stony Point section. | South Harbor section. | | |
| 1897 | 76,417.0 | 2,108.5 | | 78,525.5 | No capping stone. |
| 1898 | 38,802.2 | 52,963.9 | | 91,766.1 | |
| 1899 | 3,931.8 | | 29,968.5 | 33,900.3 | |
| 1900 | 37,291.7 | | 47,318.3 | 84,610.0 | |
| 1901 | 27,444.7 | | 331.6 | 27,776.3 | |
| 1902 | 19,504.0 | | | 19,504.0 | |
| 1903 | | | | | |
| Total | 203,391.4 | 55,072.4 | 77,618.4 | 336,082.2 | |

### ENTRANCE CHANNEL TO BUFFALO RIVER AND CITY SHIP CANAL.

This entrance channel between the United States north and south piers was maintained by the United States up to 1872, when the city of Buffalo assumed the maintenance and continued it until 1900.

The river and harbor acts of June 6, 1900, and of June 13, 1902, made special provisions "for deepening the entrance to Buffalo Harbor and the city ship canal." These acts are understood to again place the maintenance of the entrance channel with the United States.

The entrance channel was dredged where necessary to make the channel 22 feet deep at mean lake level, July–November, 1900, except over a rock shoal on the north side of the channel just west of Evans slip, which was removed to the required depth October–December, 1902. The limits of the channel were defined at the inner end to be on a line across the end of the city ship canal from the corner of Watson elevator dock to the south line of the United States property on the south pier and across the Buffalo River from the corner of the Watson elevator dock to the west side of Evans slip. The channel was dredged to within 20 feet of the piers and beyond the end of the south pier 400 feet, making a channel 180 to 200 feet wide between the piers and 300 feet wide beyond the end of the north pier.

No operations were carried on in the entrance channel during the past fiscal year, and at its close the channel was in good condition.

### REPAIRS ON PIERS AND BREAKWATERS.

No repairs were made on the north and south piers or on the old breakwater during the fiscal year.

## CARE OF PUBLIC PROPERTY AND ENFORCEMENT OF HARBOR REGULATIONS AND OF LAWS FOR THE PROTECTION OF NAVIGATION.

The inspection steamer *Gen. John M. Wilson* was on duty throughout the year on the inspection of operations on harbor works, on the care of floating plant, and on the enforcement of laws for the protection of navigation, notably the dumping of dredgings.

A watchman was on duty throughout the year at the United States engineer storehouse on the south pier, for the care of public property, and he also acted as ferryman for employees and supplies to and from the storehouse, and had charge of the automatic water gauge.

As noted under "Occupation of the United States north pier by the Delaware, Lackawanna and Western Railroad Company," a small house for the temporary storage of supplies was placed upon the United States north pier just west of the landing stairs, in September, 1903. This storehouse is marked "U. S. Receiving House," and is supplied with a derrick for handling supplies. The receiving house was also in charge of the watchman before mentioned.

The proper enforcement of the harbor regulations issued by the Secretary of War required the employment of two inspectors to enforce the rules relating to navigation through the entrance channel at restricted speed and to prevent vessels blocking the channel by lying two or more abreast at the coal trestle and elevators on the north pier. The inspectors were on duty during the navigation season only, and their enforcement of the rules resulted in a marked improvement to navigation through the narrow channel between the piers, often congested by the numerous large and small vessels passing in and out.

The water supply for the several storehouses of the United States Engineer Department and the Light-House Department, and for the dwellings of light-keepers and the United States life-saving station, all located along the United States south pier, has been for many years obtained by a single, 2-inch water pipe, supplying city water, laid across the entrance channel. This pipe became entirely inadequate for the needed supply of water and, under proper authority, arrangements were made to lay two 3-inch pipes across the channel, to replace the old 2-inch pipe. Under the arrangements effected, the pipe and fittings were furnished by the United States Light-House and United States Life-Saving departments, and the laying thereof was done by the United States Engineer Department. The pipes were successfully laid across the entrance channel so that the depth over them was not less than 20 feet at mean lake level at the pier faces and from 23 to 25 feet in the channel way. The work was fully completed in May, 1904.

## OCCUPATION OF THE UNITED STATES NORTH PIER BY THE DELAWARE, LACKAWANNA AND WESTERN RAILROAD COMPANY.

This pier is the only one of the Government harbor works permanently occupied by corporations or private parties.

The occupancy was begun in 1878. A history of this occupancy and copies of official documents relating thereto are given in the Report of the Chief of Engineers for 1889, pages 2373–2383, and in the report for 1898, page 2775 et seq.

During all of these years the Delaware, Lackawanna and Western

Railroad Company has had practically the exclusive use of the pier, the only use enjoyed by the United States being that of a landing stairs at the inner end of the pier, from which access to the United States property and storehouses on the south pier is obtained by ferriage across the entrance channel.

Many stores and supplies are constantly being received at these landing stairs for transfer across the channel to the United States Engineer, United States Light-House, and United States Life-Saving station storehouses and depots, and these stores and supplies were often exposed to damage by rain and to loss by theft, while lying at the landing stairs awaiting transfer by ferry.

The need of a temporary storage place on the north pier was apparent and urgent, and steps were taken to secure it, as shown by the following correspondence:

BUFFALO, N. Y., *September 25, 1903.*

MY DEAR COLONEL BINGHAM: Our men have told me about some measurements being made with reference to some construction of the Government near the mouth of the river. I would like to say to you that if the company can facilitate in any way any plan that you have it will now and at all times be very glad to do so. With my regards, believe me,

Sincerely yours,

JOHN G. MILBURN.

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BUFFALO, N. Y., *September 26, 1903.*

MY DEAR MR. MILBURN: Your note of September 25 was duly received. In reply, I have to thank you for your kind offer to facilitate any plan I may have, and I only wish that I had a plan. The measurements to which you refer are probably some which are being taken in order that I may be thoroughly informed as to the boundaries of streets, alleys, the Government pier, the property of the Lackawanna road, etc.

The situation of the United States, as regards receiving and handling of supplies at the mouth of the river, is an absurd one, and so extremely inconvenient as to be practically intolerable. I do not at present see what can be done, however, and certainly can not formulate any plan until I have been able to inform myself thoroughly of the facts in the case.

Sincerely yours,

THEO. A. BINGHAM,
*Major, Corps of Engineers.*

Mr. JOHN G. MILBURN,
*28 Erie street, Buffalo, N. Y.*

In September, 1903, a storehouse, 12 feet by 20 feet in size, was placed upon the north pier east of the landing stairs, and marked "U. S. Receiving House." This receiving house has since been maintained upon the pier.

### CONDITION OF THE WORKS.

At the close of the fiscal year the condition of the works was as follows:

*Entrance channel and piers.*—These works, forming the entrance to the inner harbor, which comprises Buffalo Creek and the city ship canal, were in fair condition.

The north pier remains in possession of the Delaware, Lackawanna and Western Railroad Company, and is kept in repair by that corporation.

The south pier was rebuilt with concrete from its inner end to the Buffalo light, 1,425 feet, in 1900–1901, and placed in a permanent condition. The remainder of this pier, 350 feet long at the outer end, is a timber-crib, stone-filled pier, built over thirty years ago, and the superstructure is now so badly decayed that its entire reconstruction is urgently necessary.

The reconstruction should be in concrete to conform with the remainder of the pier and place it in a permanent condition. Such reconstruction of the superstructure is estimated to cost $70 per linear foot, including contingencies and engineering, or $24,500 for the 350 linear feet.

As the old timber work is so badly decayed that the wall timbers are liable to fall out, the proposed reconstruction should not be delayed.

The entrance channel between the piers has been improved and maintained by the United States from its inner end at the junction of Buffalo Creek and the city ship canal to deep water in the lake since 1899, the river and harbor act of March 3, 1899, and of June 13, 1902, having made special provision for such improvement and maintenance, which is on the basis of securing 22 feet depth at mean lake level. The portion requiring dredging to maintain this depth is that lying between the piers for the width admissible, viz, 200 feet, widening to 400 feet beyond the outer end of the north pier. The channel is of the required depth throughout, but shoaling occurs frequently off the end of the south pier.

*Breakwater system and outer harbor.*—This system comprises four sections of breakwater separated by three entrance channels.

The north breakwater, 2,200 feet long, is a permanent concrete structure and is in good condition. This section was built under a special project, but is essentially a link in the breakwater system.

The old breakwater, 7,608 feet long, of which 4,894 feet is in permanent concrete form and 2,714 feet is timber cribwork, in good condition, except the older portions of the timber work, which require repairs estimated to cost $5,000.

The south harbor breakwater is 9,989 feet long. This is a part of the breakwater extension to Stony Point and is fully completed as specified under the contracts for that work. The northerly 7,250 feet is of rubblestone type, a permanent form, and at the close of the fiscal year was fully completed as specified in the contracts, but requires reenforcement along the inner toe with riprap stone to insure absolute stability under all conditions of storms.

Of the remaining 2,739 feet of this section of breakwater, 1,800 feet is of timber-crib-concrete type, a permanent form when fully completed, but not yet so considered, as it requires heavy reenforcement on the lake side by riprap to form a sea slope to withstand the enormous wave force to which it is exposed, and 939 feet is of the original timber-crib type, in good condition, but also requiring similar reenforcement.

At the close of the fiscal year this portion was in good condition and the reenforcement on the lake side with heavy stone riprap had been advanced so that the entire lake front was protected by riprap up to the water line and above in places.

The Stony Point breakwater is 2,803 feet long, connecting with the shore, is of timber-crib type, and is in good condition.

The outer harbor basin is in good condition, with a depth of water generally 20 to 28 feet deep at mean lake level outside of the harbor line, except at the south end at the entrance to the Lackawanna Steel Company and the Buffalo and Susquehanna Iron Company's canals, where there is an area 15 to 20 feet deep at mean lake level, and except along the harbor line generally where the depth is 16 to 18 feet.

## PROPOSED OPERATIONS AND REMARKS.

The final reenforcement of the breakwater extension to Stony Point is important and very urgent. It must be recognized that in a work of the magnitude of this extension, with new and untried features, and with the unfavorable conditions of a soft-clay bottom and a tremendous wave force to contend against, exact requirements could not be accurately foretold. It is now, however, plainly apparent that the entire lake front of the timber-crib-concrete portion of the South Harbor section of the breakwater system must be provided with a sea slope laid to the lines and capped with large capping stones in all respects similar to the sea slope of the stone breakwater adjoining it. The reenforcement of the toe of the harbor wall of the stone breakwater is also now found to be important to insure the absolute stability of that structure.

This work of reenforcement should not be delayed, and a further appropriation will be required therefor and should be made as soon as practicable.

The cost of this work is estimated at $200,000, including contingencies, and involves the placing of 150,000 tons of rubble and capping stone. The entire work should be done during the season of 1905.

The only appropriations hereafter required for Buffalo Harbor under the existing project will be for maintenance. It is difficult, and in fact impossible, to tell how much money will be required for this purpose. None of the timber-crib breakwater is in immediate need of having its wooden superstructure replaced with concrete, but it is always liable to injury by storms, etc., and true economy requires that repairs quickly follow injuries.

As the Government has over 4 miles of breakwater at this port, besides the entrance piers, there is evident likelihood that considerable sums may be required for their maintenance until all have been placed in a permanent stone or concrete form. The Government has assumed charge of the entrance channel to the extent of keeping it dredged out to the requisite depth for the large vessels trading here. The moving sands and currents tend to shoal this channel, which must be dredged out periodically.

Dredging will also be required in parts of the outer-harbor basin as the demands of commerce increase. At the present time such dredging is needed to deepen the entrance to the canals of the Lackawanna Steel Company and the Buffalo and Susquehanna Iron Company at Stony Point to 23 feet at mean lake level, and dredging will be required at other points along the harbor line as the commerce of the outer harbor develops. Such dredging is not now specifically provided for and defined in the project for improvement of Buffalo Harbor.

For maintenance funds are required for rebuilding the superstructure on 350 feet of the south pier and also for maintaining the entrance channel and repairing structures as noted under "Condition of works."

*Work yard and slip.*—For many years past the need of a storage ground, work yard, and slip for loading and unloading timber and other materials used in harbor construction has been apparent. The Government has no place for storage and dockage of this character and the rental of property for the purpose is not feasible or desirable in a crowded port like Buffalo.

Plans and estimates for such a work yard and slip have been made from time to time. The estimated cost of the work would be $73,600.

The reasons and necessities for this improvement are fully set forth in the Annual Report of the Chief of Engineers for 1903, page 2135 et seq.

It is recommended that the project for the improvement of Buffalo Harbor be extended so as to provide for the proposed work yard and slip at the estimated cost of $73,600, and that this sum be added to the estimate of funds required, summed up as follows:

*Maintenance.*

| | |
|---|---|
| For reenforcement of the breakwater extension to Stony Point | $200,000 |
| Concrete superstructure on south pier | 24,500 |
| Repairs of structures | 10,000 |
| Dredging entrance channel | 10,000 |
| Total | 244,500 |

## *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $112,397.12 |
| Received from sales | 750.00 |
| | 113,147.12 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 85,383.88 |
| July 1, 1904, balance unexpended | 27,763.24 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 244,500.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

---

STATEMENT OF ALLOTMENTS AND APPROPRIATIONS.

| | | | |
|---|---|---|---|
| May 26, 1826 | $15,000.00 | March 3, 1875 | $100,000.00 |
| May 19, 1828 | 34,206.00 | August 4, 1877 | 85,000.00 |
| April 23, 1830 | 15,488.00 | June 18, 1878 | 80,000.00 |
| March 2, 1831 | 12,900.00 | March 3, 1879 | 100,000.00 |
| July 3, 1832 | 10,300.00 | June 14, 1880 | 90,000.00 |
| March 2, 1833 | 31,700.00 | March 3, 1881 | 90,000.00 |
| June 28, 1834 | 20,000.00 | August 2, 1882 | 125,000.00 |
| July 7, 1838 | 68,500.00 | July 5, 1884 | 100,000.00 |
| June 11, 1844 | 40,000.00 | August 5, 1886 | 112,500.00 |
| August 30, 1852 | 14,000.00 | August 11, 1888 | 225,000.00 |
| March 3, 1853 | 349.05 | September 19, 1890 | 300,000.00 |
| March 2, 1855 | 452.32 | July 13, 1892 | 300,000.00 |
| June 28, 1864 | 15,000.00 | August 18, 1894 | 70,000.00 |
| July 2, 1864 | 37,500.00 | June 4, 1897 | 481,250.00 |
| June 23, 1866 | 131,000.00 | July 1, 1898 | 489,746.00 |
| March 2, 1867 | 100,000.00 | March 3, 1899 | 485,498.00 |
| April 10, 1869 | 89,100.00 | March 3, 1899 | 75,000.00 |
| July 10, 1870 | 80,000.00 | March 3, 1901 | 400,000.00 |
| March 3, 1871 | 100,000.00 | June 13, 1902 | 30,000.00 |
| June 10, 1872 | 75,000.00 | June 28, 1902 | 200,000.00 |
| March 3, 1873 | 75,000.00 | April 9, 1904 (sales) | 750.00 |
| February 23, 1874 | 20,000.00 | | |
| June 23, 1874 | 75,000.00 | Total | 5,000,239.37 |

### COMMERCIAL STATISTICS OF BUFFALO HARBOR, NEW YORK.

[Compiled from records furnished by collector of customs and from annual report of the Chamber of Commerce of Buffalo, N. Y.]

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 3,086 | 5,257,916 | 312 | 133,945 | 3,176 | 5,317,093 | 354 | 201,097 |
| Sail and barges | 208 | 153,300 | 683 | 177,294 | 225 | 166,533 | 683 | 179,541 |
| Total | 3,294 | 5,411,216 | 995 | 311,239 | 3,401 | 5,483,626 | 1,037 | 380,638 |

| | | |
|---|---|---|
| Total arrivals and departures: | | |
| Number | | 8,727 |
| Tonnage | | 11,586,719 |
| Decrease of tonnage, 1903 under 1902 | | 69,561 |
| Amount of revenue collected, year 1903: | | |
| Lake commerce | $86,961.57 | |
| Rail commerce | 640,561.42 | |
| Total | | $727,522.99 |
| Value of imports:[a] | | |
| By lake | 689,885.00 | |
| By rail | 4,512,625.00 | |
| | | 5,202,510.00 |
| Value of exports:[a] | | |
| By lake | 395,799.00 | |
| By rail | 20,898,411.00 | |
| | | 21,294,210.00 |

Enrolled tonnage, port of Buffalo, 1903, 169,043 gross tons. Greatest draft of vessels, 19 feet.

*Receipts by lake for the year 1903.*

[Tons of 2,000 pounds.]

| | | | |
|---|---|---|---|
| Barley | 256,359 | Oatmeal | 1,780 |
| Broom corn | 568 | Oil | 75 |
| Canned goods | 131 | Oil cake | 51,007 |
| Corn | 1,214,219 | Papers | 204 |
| Corn meal | 2,836 | Pease | 3,795 |
| Copper | 90,993 | Pork | 375 |
| Flour | 1,124,303 | Rags | 4,346 |
| Flaxseed | 328,826 | Rubber | 4,146 |
| Feed | 213,541 | Rye | 90,075 |
| Fish | 1,005 | Soap | 45 |
| Glucose | 21,892 | Starch | 1,822 |
| Iron ore | 1,848,973 | Seeds | 8,436 |
| Iron, pigs | 26,057 | Spelter | 3,315 |
| Lead | 15,772 | Shingles | 26,360 |
| Lard | 1,077 | Posts | 800 |
| Lumber | 314,825 | Tallow | 3,984 |
| Lath | 2,962 | Ties | 4,983 |
| Malt | 578 | Wheat | 1,213,659 |
| Merchandise | 79,998 | Wool | 10,835 |
| Nails | 417 | | |
| Oats | 495,617 | Total | 7,479,991 |

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[a] Includes port of Tonawanda, embraced in Buffalo Creek district.

*Shipments by lake for the year 1903.*

[Tons of 2,000 pounds.]

| | |
|---|---|
| Coal | 3,261,544 |
| Cement and plaster | 566,385 |
| Salt | 70,628 |
| Sugar | 419,724 |
| Total | 4,318,281 |

The following statistics of the canal commerce of Buffalo for the year 1903 are compiled from the report of the division superintendent of the Erie Canal:

| | |
|---|---|
| Canal clearances | 3,487 |
| Freight coming to Buffalo ... tons.. | 577,444 |
| Freight leaving Buffalo ... do... | 746,772 |
| Steamers and canal boats navigating from Buffalo on the canal (about) | 700 |
| Average freight rate, Buffalo to New York, for wheat per bushel ...cents.. | 4 |

Assuming that the number of arrivals of canal boats equaled the number of clearances, the grand total of the commerce of Buffalo carried on by lake, river, and canal for the season of 1903 is as follows:

| | Arrivals and departures. | Receipts of freight. | Shipments of freight. |
|---|---|---|---|
| Lake and river | 8,727 | 7,479,991 | 4,318,281 |
| Canal | 6,974 | 577,444 | 746,772 |
| Total | 15,701 | 8,057,435 | 5,065,053 |

Total receipts and shipments, 13,122,498.

NOTE.—A large amount of miscellaneous freight is received and shipped on passenger line steamers, of which no record is available.

About 750,000 passengers arrive and depart by water annually.

## Q Q 4.

## IMPROVEMENT OF LAKE ERIE ENTRANCE TO BLACK ROCK HARBOR AND ERIE BASIN, NEW YORK.

### REPORT OF OPERATIONS.

A contract for the entire channel and basin excavation of the project was entered into with the Buffalo Dredging Company, Buffalo, N. Y., April 29, 1903.

Dredging operations to remove the sand overlying the rock above grade were begun on April 30, 1903. On May 1 the dredge in operation was withdrawn as unsuitable and operations were not resumed until June 20, 1903, when a large dredge was placed on the removal of sand from the channel portion of the work, from the main entrance channel to Buffalo Harbor to the Erie Basin, up to July 1, 1903.

The cost of the work performed was $9,249.24, being for 14,014 cubic yards of channel excavation, at 66 cents per cubic yard, the contract price.

At the beginning of the fiscal year (July 1, 1903) the large dredge, *B. D. Co. No. 7*, was actively engaged in removing the material overlying the rock in the channel portion of the work. Later on this dredge was supplemented by several smaller dredges, which, however, on account of their small size, excavated comparatively a small amount of material.

The contract requirements of the channel excavation imply the excavation of approximately 239,000 cubic yards of sand and clay, and by

September 17, 1903, when the excavation of sand, etc., overlying rock was suspended, 220,000 cubic yards, or 92 per cent, of this material had been removed.

Rock drilling and blasting operations were commenced July 14, 1903, at a point 1,200 feet northerly from the south end of the north breakwater, and 180 feet eastward from the northerly line of the proposed channel.

Drilling and blasting operations continued until November 7, 1903, work being suspended on this date on account of a strike, the drill-boat employees wanting pay for lost days, which demand was not granted by the contractors.

The area drilled over to the close of work in 1903 comprised 285,000 square feet, of which 186,750 square feet are located between stations 12 and 19, being the western half of the north end of the channel, and the remaining 98,350 square feet are located just off the Philadelphia and Reading coal trestle, in the branch channel leading to the Erie Basin.

The greatest number of drill boats engaged in the work at one time was five; generally four were engaged.

The following table shows the operations of the drill boats for the working period between July 14 and November 7, 1903, inclusive. The drill boats were operated day and night, in two shifts of eleven hours each.

| Drill boat. | Dimensions. |  | Number of drills. | Total number of days worked. |  |  |  |  |  | Number of holes drilled. | Number of linear feet drilled. | Average depth of holes. | Number of holes per drill per day of 24 hours. | Number of linear feet per drill per day of 24 hours. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Length. | Beam. |  | July. | August. | September. | October. | November. | Total. |  |  |  |  |  |
|  | Feet. | Feet. |  |  |  |  |  |  |  |  |  | Feet. |  |  |
| No. 1 | 78 | 25 | 3 | 16 | 26 | 24 | 22 | 6 | 94 | 6,128 | 26,581 | 4.34 | 22 | 91 |
| No. 2 | 108 | 30 | 4 | .... | 24 | 24 | 24 | 6 | 78 | 5,868 | 26,718 | 4.55 | 19 | 86 |
| No. 3 | 86 | 26 | 2 | .... | .... | .... | 17 | 6 | 23 | 722 | 3,085 | 4.27 | 16 | 68 |
| No. 4 | 98 | 25 | 2 | .... | 1 | 24 | 7 | 6 | 38 | 1,074 | 5,272 | 4.91 | 14 | 69 |
| Erie | 80 | 24 | 2 | .... | 4 | 23 | 14 | .... | 41 | 1,804 | 7,600 | 4.21 | 22 | 92 |
| Total | ...... | ...... | 13 | 16 | 55 | 95 | 84 | 24 | 274 | 15,596 | 69,256 | 4.44 | 19 | 86 |

The average depth of rock above the required grade of 23 feet below mean lake level was 2.44 feet; but in order to insure the required depth after blasting and dredging, the holes were put down to 25 feet below mean lake level; which accounts for the greater average depth of holes, as stated in the table.

The work of dredging drilled and blasted rock was commenced on September 21, 1903, and suspended for the season November 24, 1903. During this period, the one dredge employed, *B. D. Co. No. 7*, worked forty-five days, and 37,570 cubic yards, scow measure, or 18,785 cubic yards, estimated place measure, of drilled and blasted rock was dredged. Much of this material was deposited on the harbor slopes of the stone breakwater section of the Buffalo breakwater, materially reenforcing and strengthening that structure. This was done without cost to the Government.

The rock area dredged lies between stations 12 and 19, in the northerly half of the channel. The area excavated was approximately 700 feet long and 210 feet wide. The measurements of the dredged material would indicate the removal of a depth of 3.4 feet of rock, measured in place.

The winter of 1903-4 was very severe, and the area covered by the proposed channel and basin was deeply frozen over. Advantage was taken of this condition to thoroughly test, by soundings through the ice, the condition of the dredged channel, as provided in paragraph 76 of the specifications of the contract.

The outer half, adjacent to the north breakwater, being a section 1,000 feet long and 400 feet wide, was sounded every 50 feet, 237 soundings being taken in all. In addition 18 borings to rock were taken. The major portion of this section of the channel was found to be dredged to the required depth, viz, 23 feet below mean lake level.

On the inner half of the channel, from station 10 to the United States harbor line, the soundings were taken every 25 feet each way, 942 in all being taken. There were also 193 borings made to rock. On this half, an area about 700 feet long and 210 feet wide was found to be dredged to the required depth, except on a few small spots.

Outside of the two areas noted the channel still requires dredging of from 1 to 3 feet of earth, as well as much of the rock drilled and blasted during the season of 1903, and of rock yet to be drilled and blasted.

The boundaries of the basin section were also determined on the ice, and 81 soundings and 81 borings to rock were made along the westerly boundary in the vicinity of the Bird Island pier. This survey and soundings were made February 11 to 27, 1904.

Operations for the season of 1904 were not begun until May 9, when one dredge resumed excavation in the channel from Buffalo main entrance channel to Erie Basin at the Erie Basin end. Excavation was continued with this one dredge during the remainder of the fiscal year.

Owing to the strike of rock drillers, the drilling and blasting of rock was not resumed until the settlement of the strike (June 8, 1904) when two drill boats operating seven drills resumed operations in the channel at the Erie Basin end. Two drill boats operating 6 drills were added to the force June 24, and the drilling and blasting of rock was continued with the four drill boats during the remainder of the fiscal year.

At the close of the fiscal year the channel from Buffalo main entrance channel to Erie Basin had been dredged to the required depth of 23 feet at mean lake level for a length of 1,000 feet from the north breakwater; 1,000 feet thence to the State breakwater had been dredged 19 to 23 feet deep; the area at the entrance to Erie Basin had been half completed to the required depth. Excavation of the basin was begun June 29, when one dredge began dredging sand overlying rock.

About one-third of the excavation has been done. The total excavation credited and paid for amounts to 238,883 cubic yards, place measure.

### PROPOSED OPERATIONS, AND REMARKS.

The work of channel and basin excavation will be continued under the contract.

There will be required to be appropriated for the ensuing fiscal year the balance of the amount estimated and required for the completion of the existing project, viz, $289,643.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $399,294.50 |
| Amount appropriated by sundry civil act approved April 28, 1904 | 125,000.00 |
| | 524,294.50 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 147,687.40 |
| July 1, 1904, balance unexpended | 376,607.10 |
| July 1, 1904, amount covered by uncompleted contracts | 663,102.92 |
| Amount (estimated) required for completion of existing project | 289,643.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 289,643.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

#### STATEMENT OF APPROPRIATIONS.

| | |
|---|---|
| June 13, 1902 | $200,000 |
| March 3, 1903 | 200,000 |
| April 28, 1904 | 125,000 |
| Total | 525,000 |

#### CONTRACTS IN FORCE.

*Contract for excavation in Lake Erie entrance to Black Rock Harbor and Erie Basin, New York, dated February 16, 1904.*

Name of contractor: Buffalo Dredging Company.

Rates: Excavation of channel, per cubic yard, place measurement, 66 cents; excavation of basin, per cubic yard, place measurement, $1.84; placing rock with derrick, per ton, $1.25.

Date of approval: March 3, 1903.

Date of commencement: April 29, 1903.

Date of expiration: December 31, 1906.

#### COMMERCIAL STATISTICS FOR LAKE ERIE ENTRANCE TO BLACK ROCK HARBOR AND ERIE BASIN, NEW YORK.

For the commercial statistics relating to this work reference is made to the statistics of Buffalo Harbor. There are no means of separating the statistics relating to the portion of the harbor covered by this improvement from the general statistics of the harbor.

## Q Q 5.

## IMPROVEMENT OF BUFFALO ENTRANCE TO ERIE BASIN AND BLACK ROCK HARBOR, NEW YORK.

A full description of the locality and a discussion of the project for the work is printed, with map, in House Document No. 72, Fifty-fifth Congress, first session, and in Report of the Chief of Engineers for 1897, page 3245 et seq.; and a history of the work and its completion in the Report of the Chief of Engineers for 1901, page 3324 et seq.

### REPORT OF OPERATIONS.

There were no operations during the past fiscal year, and the entire breakwater is in good condition.

### REMARKS.

The project being completed, no further estimate is made.

It is desired to keep the funds now on hand for maintenance and contingencies.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $3, 264. 44 |
| July 1, 1904, balance unexpended | 3, 264.44 |

### APPROPRIATIONS.

| | |
|---|---|
| March 3, 1899 | $50, 000. 00 |
| June 6, 1900 | 191, 701. 25 |
| Total | 241, 701. 25 |

### COMMERCIAL STATISTICS.

For the commercial statistics relating to this work reference is made to the statistics of Buffalo Harbor. There are no means of separating the statistics relating to the portion of the harbor covered by this improvement from the general statistics of the harbor.

## Q Q 6.

## IMPROVEMENT OF TONAWANDA HARBOR AND NIAGARA RIVER, NEW YORK.

### REPORT OF OPERATIONS.

Two hundred and fifty-seven thousand seven hundred dollars was appropriated by the river and harbor act of June 13, 1902.

Bids for the hire of dredging plant were invited July 23, 1902, and a contract was entered into with the lowest bidders, the Lake Erie Dredging Company, September 6, 1902, who commenced operations September 12, 1902, and have since then continued operations with two to four dredges, except during the winter months.

At the beginning of the fiscal year two dredges were at work on the excavation of the channel through the lower shoal in the main channel of Niagara River abreast of Tonawanda Island.

Operations were continued with two dredges until September 17, 1903, when the channel across this shoal, 1,200 feet long, was completed to the required width of 400 feet and depth of 18 feet at mean river level.

The following table shows all of the work done in excavating the channel across the lower shoal:

| | | |
|---|---|---|
| Cost of hired plant | | $29, 377 |
| Hardpan, gravel and sand removed, scow measure | cubic yards.. | 68, 033 |
| Cost per cubic yard | | $0. 43 |
| Average depth of material removed | feet.. | 2. 5 |

During the season of 1902 the dredging of the channel along the front of the village (now city) of Tonawanda, Erie County, and of the channel between the Tonawanda front and Tonawanda Island, above the island bridge, had been about one-fourth completed, but further operations were suspended until the completion of more urgent work on the lower shoal in the main river channel.

Dredging was resumed in the channel above the island bridge July 17, 1903, and carried on with from one to three dredges until work was suspended for the winter on January 2, 1904; again resumed with one dredge on April 23, 1904, and completed May 3, 1904. This section of Tonawanda Harbor, known as "the island channel above the bridge," extends from a point opposite the Tonawanda Water Works chimney to the island bridge. It was completed 400 feet wide and 18 feet deep at mean river level, as shown in the following table:

| | |
|---|---|
| Cost of hired plant | $52,549 |
| Hardpan, sand and gravel removed, scow measure ...cubic yards.. | 111,604 |
| Cost per cubic yard | $0.469 |
| Average depth of material removed ...feet.. | 2.7 |

Dredging of the section known as "the island channel below the island bridge," extending from the bridge to the foot of Tonawanda Island, was begun September 17, 1903, with one dredge. A second dredge began operations October 26, 1903, and the two dredges continued operations until suspension for the winter on January 2, 1904.

Operations were resumed with one dredge April 20, 1904, a second dredge began April 25, 1904, a third dredge April 30, 1904, and a fourth dredge May 2, 1904.

Operations were continued with four dredges to June 10, when one dredge was transferred to the dock front of the Tonawanda Iron and Steel Company. The three remaining dredges continued operations, and at the close of the fiscal year this island channel below the bridge was so nearly completed as to be fully available. The channel will be fully cleaned up before August 1, 1904.

The work done on the "island channel" below the bridge during the fiscal year is shown in the following table:

| | |
|---|---|
| Cost of hired plant | $51,047.50 |
| Gravel, clay, hardpan and bowlders removed, scow measure..cubic yards.. | 137,433 |
| Cost per cubic yard | $0.372 |
| Average depth of material removed ...feet.. | 3 |

One dredge was operated from June 10 to June 17, removing soft clay and bowlders along the frontage of the Tonawanda Iron and Steel Company's dock. A large log, 13 large bowlders and many small ones were removed, and the channel dredged to the required depth of 18 feet.

On the completion of this work (June 17) the dredge was transferred to the westerly berm of the channel around the foot of Tonawanda Island, which required straightening and widening to admit of vessels towing around the foot of the island.

At the close of the fiscal year the above work was well under way. The work done is shown in the following table:

| | |
|---|---|
| Cost of hired plant | $2,709 |
| Clay, hardpan, and bowlders removed, scow measure ...cubic yards.. | 7,949 |
| Cost per cubic yard | $0.341 |
| Average depth of material removed ...feet.. | 3 |

### PROPOSED OPERATIONS AND REMARKS.

The originally estimated cost of the project in 1891 was $1,152,987.93. It may be explained that the project was extended in 1896 to the north line of the village of North Tonawanda, in order to enable work to be done on the shoals at the foot of Tonawanda Island and abreast of this island, and to extend the channel 400 feet wide and 18 feet deep through the shoal river along the north front of North Tonawanda.

The project was further extended in 1902 to include the dredging of the frontage on Niagara River of the village of Tonawanda, Erie County, and the dredging of Tonawanda Creek, which forms a part of Tonawanda Harbor, from Niagara River to the State dam. To allow for this work the estimate was increased $27,000, making the revised estimate of cost $1,179,987.93.

Taking the sum of appropriations ($682,700) from the revised estimate leaves $497,287.93.

A large part of the work embraced by the original project has been done at a cost much below the original estimate. The knowledge gained in the conduct of the work indicates that this sum of $497,287.93 will do all the remaining necessary work embraced in the original project and in the extensions of the project.

There is, however, no present demand for extending the channel 400 feet wide and 18 feet deep through the shoal river along the front of North Tonawanda from the foot of Tonawanda Island to the north line of North Tonawanda, and as the funds available will complete the necessary work above the foot of Tonawanda Island, it is not deemed necessary to ask for an appropriation for the coming fiscal year.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $210,144.72 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 99,821.67 |
| July 1, 1904, balance unexpended | 110,323.05 |
| July 1, 1904, amount covered by uncompleted contracts | Indefinite. |

### APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| August 11, 1888 | $100,000 | March 3, 1899 | $75,000 |
| September 19, 1890 | 75,000 | June 13, 1902 | 257,700 |
| July 13, 1892 | 75,000 | | |
| August 18, 1894 | 50,000 | Total | 682,700 |
| June 3, 1896 | 50,000 | | |

### CONTRACTS IN FORCE.

*Contract for hire of dredging plant in Niagara River and Tonawanda Harbor, New York, dated September 6, 1902.*

Name of contractor: The Lake Erie Dredging Company, Buffalo, N. Y.

Rates: Dredges, per day of eight hours, $112; drill boats, per day of eight hours, $112; additional tugs, per day of eight hours, $24.

Date of approval: October 30, 1902.

Date of commencement: September 12, 1902.

Date of expiration: December 31, 1904.

### COMMERCIAL STATISTICS.

[Furnished by the collector of customs, Buffalo Creek and Niagara districts.]

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| District and vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Buffalo Creek: | | | | | | | | |
| Steam | 56 | 30,215 | 11 | 2,506 | 60 | 29,817 | 10 | 930 |
| Sail and barges | 48 | 25,206 | 12 | 4,864 | 53 | 27,487 | 6 | 1,548 |
| Niagara: | | | | | | | | |
| Steam | 380 | 269,224 | 31 | 10,347 | 391 | 272,417 | 26 | 9,408 |
| Sail and barges | 339 | 197,602 | 41 | 15,080 | 343 | 198,081 | 28 | 8,475 |
| Total | 823 | 522,247 | 95 | 32,797 | 847 | 527,802 | 70 | 20,361 |

| | |
|---|---|
| Total arrivals and departures: | |
| Number | 1,835 |
| Tonnage | 1,103,207 |
| Increase of tonnage, 1903 over 1902 ... tons.. | 120,239 |
| Amount of revenue collected, year 1903, Niagara district only | $63,002.06 |
| Value of imports by lake, year 1903, Niagara district only | $516,047.00 |
| Value of exports by lake, year 1903, Niagara district only | None. |
| Enrolled gross tonnage, Niagara district, 1903 | 20,423 |
| Greatest draft of vessels ... feet.. | 15 |

*Receipts by lake and river for the year 1903.*

[Tons of 2,000 pounds.]

| | |
|---|---|
| Lumber | 797,532 |
| Shingles | 996 |
| Lath | 987 |
| Railroad ties | 4,542 |
| Posts | 6,516 |
| Iron ore | 289,706 |
| Pig iron | 5,350 |
| Telegraph poles | 2,000 |
| Miscellaneous | 269 |
| Total | 1,107,898 |
| Shipments by lake and river | None. |
| Shipments by Erie Canal ... tons.. | 373,492 |
| Lumber shipments by Erie Canal ... feet B. M.. | 157,377,115 |

*Number of vessels passing the International Bridge, Niagara River, 1903.*

[Furnished by R. J. McMurray, captain of the tug *International*.]

| | |
|---|---|
| Steamers | 4,559 |
| Other vessels | 1,271 |
| Total | 5,830 |
| Season of navigation, April 1 to December 22, 1903 ... days.. | 266 |
| Number of times the bridge draw was opened during season | 2,740 |
| Average number of times bridge draw was opened per day | 10.3 |

## Q Q 7.

## PRELIMINARY EXAMINATION AND SURVEY OF BLACK ROCK HARBOR, NEW YORK, AROUND THE RAPIDS AND SHOALS AT THE HEAD OF NIAGARA RIVER.

[Printed in House Doc. No. 428, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, January 12, 1904.*

Sir: I have the honor to submit herewith reports, dated October 1, 1902, by Maj. Thos. W. Symons, Corps of Engineers, and September 29, 1903, by Maj. Theo. A. Bingham, Corps of Engineers, on preliminary examination and survey, respectively, of Black Rock Harbor, New York, with a view to obtaining a suitable channel for deep-draft vessels around the rapids and shoals at the head of Niagara River. These reports are made in compliance with a requirement in the river and harbor act approved June 13, 1902, and Major Symons reports the locality to be worthy of improvement by the General Government in the manner outlined in his report on preliminary examination, his views being concurred in by the division engineer, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, United States Army, retired).

Major Bingham presents a detailed plan for improvement which contemplates the excavation of a channel 23 feet deep varying in width from 250 feet to 500 feet, and provided at the lower end of the harbor near the foot of Squaw Island with a lock opening into Niagara River below the shoals and rapids. The work proposed involves the removal of the existing wall of the Erie Canal and the merging of the waters of the canal with those of Black Rock Harbor along the greater part of the proposed channel. The estimated cost of the plan presented is $3,473,239, which includes the acquisition of certain State and private property. To enable vessels of all classes engaged in commerce to pass from Lake Erie into the natural harbor of Niagara River below the shoals and rapids, there would be required in addition to the work provided for in the above estimate, the excavation to a depth of 23 feet and a width of 400 feet of the eastern channel of the river below the lock for a distance of about 2½ miles, the cost of which would be approximately $500,000.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, under the provisions of sections 3 and 14 of the above-mentioned act, and attention is invited to its reports thereon in indorsements of December 4, 1902, and December 22, 1903. In the opinion of the Board at least $4,500,000 would be required to complete the proposed improvement, and in view of the facts presented in its report of December 22, 1903, the Board concludes that it is not advisable for the United States to commence the improvement of Black Rock Harbor at the present time with a view to obtaining a suitable channel for deep-draft vessels around the rapids and shoals at the head of the Niagara River.

I concur in the opinion of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF BLACK ROCK HARBOR, NEW YORK, AROUND THE RAPIDS AND SHOALS AT THE HEAD OF NIAGARA RIVER.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., October 1, 1902.*

GENERAL: I have the honor to submit the following report of a preliminary examination of—

Black Rock Harbor, with a view to obtaining a suitable channel for deep-draft vessels around the rapids and shoals at the head of the Niagara River.

It is my opinion that the work as outlined above is not only worthy of being undertaken by the United States, but ought to be undertaken, and it is advisable to do so with the least practicable delay.

## DESCRIPTION.

Lake Erie converging at its eastern end into comparatively narrow outlines has its outlet in the Niagara River, a general description of which is unnecessary. For a distance of 4 miles from its head the river flows through a single channel, then it is divided into two channels by Strawberry and Grand islands. Below Grand Island the river flows through a single channel again until the great rapids and falls are reached.

The city of Buffalo has its front on Lake Erie and on the upper part of the single channel of the Niagara as it leaves the lake. The map[a] of Buffalo Harbor and the Niagara River to the Falls which I send herewith, in separate roll, shows clearly the situation.

The single channel of the Niagara, from Lake Erie to Strawberry Island, is narrow, swift, and shallow, with rocky bed, and exceedingly difficult to navigate, while most of the river surrounding Grand Island is deep and wide, with gentle currents, and capable of accommodating the largest ships of the lakes.. The narrow gorge and shallows at the head of the river can only be navigated by small vessels of 13 to 14 feet draft, and then only at considerable peril in going down, and with a large expenditure of power in coming up.

The current of the river at its head begins at about the location of the Horseshoe reef light. For about 1¼ miles the current velocity is from 2 to 3 miles per hour, this part of the river being wide, shallow, and rocky. Thence follows the engorged section beginning about one-eighth of a mile above the Buffalo waterworks crib and extending to the foot of Squaw Island, 3¼ miles from the Horseshoe reef light. This engorged section is 1,600 feet to 2,000 feet wide, the narrowest part being about three-fourths of a mile in length, from one-eighth of a mile above to five-eighths of a mile below the waterworks crib. The velocity of the current through this portion of contracted channel is estimated at 4 to 5 miles per hour at low to mean stages of the river and 5 to 7 miles per hour at high stages of river. From the point about five-eighths of a mile below the waterworks crib to the foot of Squaw Island the channel is deep, somewhat wider, and the current some less rapid than in the 1-mile stretch above it.'

Numerous observations of the current velocity have been made at or just below the International Bridge in connection with river discharge work. These observations determine the velocity in the thalweg to be 6 feet per second or 4 miles per hour at low to mean stages of the river and 7 to 7½ feet per second or 4¾ to 5$\frac{1}{10}$ miles per hour at high stages of water.

The object of the proposed improvement is to enable the deep-draft ships of the lakes to reach the quiet, deep waters below the shoals and rapids at the head of the river, and thus give to general commerce and all the territory lying between Lake Erie and Niagara Falls the great benefit that would arise therefrom.

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[a] Not printed.

### PRESENT PROJECT.

In 1888 a project was adopted for improving the Niagara River from Lake Erie to Tonawanda. Stated briefly, this was to remove rocks and shoals in the river so as to make a channel deep enough for vessels of 16 feet draft at mean river stage. This has been largely accomplished, but of late years the river and lake levels have been so low that the actual draft in the completed channel has been limited to about 14 feet.

This project is by no means a satisfactory one, and for several reasons: It does not furnish a remedy for the swiftness of water through the gorge, which runs from 4 to 7 miles per hour; it accommodates only boats of the smaller class, the old-fashioned freight-carrying boats of the lakes which are becoming fewer and fewer every year, and it can not be extended and enlarged to overcome the swiftness and shallowness of the channel without excavating wide and deep channels through the natural rock dam at the head of the river, which would lower the waters of Lake Erie, to the general detriment of all the cities and the commerce on the lake. In order to accomplish the object aimed at, of bringing this portion of this great navigable river into the Great Lakes system without detriment to the commerce of the lakes, an entirely new project must be adopted.

### BLACK ROCK HARBOR.

In the early days of commercial development at this point the town of Black Rock, situated on the Niagara River at its head, had an independent existence and was a rival to Buffalo, of which it is now a part. As a protection to vessels and to overcome the rapids and shoals of the upper gorge, Black Rock Harbor was built. This is in reality a canal with a wide bell-shaped upper end, built along the east bank of the river and located partially between the main shore and Squaw Island, and with a lock at its lower end 36½ feet wide by 200 feet long between quoins, and with a depth on its miter sills of 9½ feet at mean river level. This harbor and canal was of sufficient capacity to accommodate the ordinary vessels of the olden days of the past century but is of little use now, and has been allowed to shoal up so that it has not at present its original capacity. It is the radical improvement of this harbor or canal to fit it to modern conditions that is sought. A brief history of Black Rock Harbor is published in the Annual Report of the Chief of Engineers for 1901, page 3326.

### THE ERIE CANAL.

The Erie Canal heads in Lake Erie at the mouth of Buffalo Creek and extending northward is located just inside of and adjacent to Black Rock Harbor for the entire length of the latter. The Erie Canal, in this portion of its course, originally formed a part of Black Rock Harbor, from which it is now separated by a narrow embankment or wall. At the lower end of the harbor this wall or embankment has disappeared, if it ever existed, so that the waters of the two freely mingle.

### PROPOSED PLAN OF IMPROVEMENT.

The proposed plan of improvement is to widen Black Rock Harbor to its original width by removing the wall that separates it from the

Erie Canal, which once formed a part of it, thus making it from 250 to 500 feet wide, instead of about 125 feet wide as at present; the resultant waterway then to be deepened sufficiently to accommodate the largest vessels of the lakes, with a lock at its downstream end sufficient to overcome the fall of the river. The lift of the lock would be about 5 feet, and it would be situated near the lower end of Squaw Island, in a position convenient of access by vessels navigating either channel of the river below the shoals and rapids. This canal and lock will enable all vessels, of whatever draft or width engaged in lake commerce, to pass from Lake Erie into the splendid natural harbor of the Niagara River below the shoals and rapids at its head.

### JUSTIFICATION OF THE IMPROVEMENT.

This is believed to be a justifiable improvement for several reasons: Because of its central geographical situation, its water transportation by the Great Lakes, the Erie Canal, and the Welland Canal, its many trunk lines of railroad, its vicinity to the coal fields of Pennsylvania, and especially to the great water power of Niagara Falls, this general locality between Lake Erie and Niagara Falls is rapidly becoming a very extensive and important manufacturing center, and its future in this regard is almost boundless if proper advantage is taken of natural conditions and necessary and reasonable improvements in these natural conditions are made.

The highest industrial development of the country demands that all along this Niagara frontier there shall be assembled conveniently and without hindrance transportation by lake, river, canal, and rail, and the power generated at Niagara Falls. The benefits to result from the proposed improvements are so great, so needed, so undoubted, and so immediate, and of such general usefulness that I have no hesitation in recommending that they be undertaken by the Government.

### REGULATION OF LAKE LEVELS.

The proposed improvement must be an essential feature in any plan for the radical regulation of the level of Lake Erie. This is a subject which is under serious consideration at the present time and by law is to be referred to an international Commission. All the feasible plans for the lake-level regulation which have been suggested look to the building of a dam across the foot of the lake. If this should be built the conservation of the navigation of the Niagara River would require the construction of the canal herein recommended or one of similar character. If the improvements herein proposed be carried out it would open and clear the way for any desired action in reference to lake-level regulation.

### SHIP CANAL.

The proposed improvement would be an essential part of any plan for a ship canal for lake vessels to reach the sea. Surveys and estimates for such a ship canal have been made by a Government Board, and these include the canal from Lake Erie to the quiet waters around Grand Island.

### THE ERIE CANAL ENLARGEMENT.

There is a very large party in the State of New York which is working hard to get the State to enter upon the radical enlargement of the Erie Canal, making it of a capacity for barges of 1,000 tons burden, with lock capacity for two such barges at once. A few years ago the State expended $9,000,000 for improving the present small canal, and two years ago it made an appropriation of $200,000 for the necessary surveys and estimates for this larger barge canal. These surveys and plans have been completed, and the estimated cost of the improvement of the Erie Canal is about $70;000,000. Both political parties in their recent State conventions have in their adopted platform approved the enlargement of the canal as proposed, rendering it almost a certainty that it will be entered upon in the near future.

The canal herein proposed to be built by the Government would fit in to this plan for the enlarged Erie Canal, and it would thus be a benefit, not only to lake navigation, but to the navigation of the proposed enlarged Erie Canal, the commerce on which would be very large and important.

### COMMERCIAL STATISTICS.

There are a large number of existing commercial and manufacturing industries at Niagara Falls, North Tonawanda, Tonawanda, and Black Rock that would be directly or indirectly benefited by the construction of the canal around the shoals and rapids at the head of the Niagara River.

### NIAGARA FALLS.

One of the greatest industrial movements and growths of recent times has been brought about by the development of the power of Niagara Falls. This is the greatest present and prospective electrical power development in the world. It is summarized as follows:

The Niagara Falls Power Company now generates 50,000 electrical horsepower, of which 35,000 is in use at Niagara Falls and 15,000 in Buffalo and elsewhere. This company has constructed a second wheel pit and power house, and is installing apparatus for generating 55,000 electrical horsepower additional, a considerable portion of which is under contract in advance to supply the increased needs of manufacturers already located at the Falls.

The Niagara Falls Hydraulic Power and Manufacturing Company has developed and is supplying for commercial purposes 35,000 electrical horsepower.

On the Canadian side the Canadian Niagara Power Company is engaged in the construction of a tunnel and other hydraulic arrangements for the development of 100,000 electrical horsepower, and has arranged for the first installation of 30,000 electrical horsepower, to be completed by July 1, 1904. Arrangements have been made for connecting the power house of this company with the power house of the Niagara Falls Power Company, with a view to using a large part of the power generated in Canada on the American side of the river.

The Ontario Power Company is located on the Canadian side of the river. It has charters and plans for two different schemes for power development, each for 150,000 electrical horsepower—300,000 electrical horsepower in all. One of these is under construction. The company is building a fore bay for the control of water sufficient to generate 150,000 electrical horsepower, and has let a contract to the Westinghouse Company for the installation of machinery to generate 30,000 electrical horsepower, which is to be ready by January 1, 1904. The Ontario Power Company is composed of citizens of the United States and it is expected that the power will be principally used in this country.

The amount of money invested in these electrical power developments which are under way will be at least $25,000,000.

A list of the principal manufacturing concerns located at Niagara Falls and their products, is given below. They are mostly operated by electrical power from the Falls, or by direct hydraulic power therefrom:

Acetylene Manufacturing Company: Preparations of calcium carbide.

Acker Process Company: Caustic soda and bleaching powder.

Alloy Smelting Company: Ferro-chrome and other alloys.

The Ampere Electro-Chemical Company: Manufacturers of various chemical products.

Ark-Brand Paint Company: Mixed paints.

Atmospheric Products Company: Manufacturers of nitric acid and of nitrates and nitrites.

C. M. Borter: Planing mill.

Buffalo and Niagara Falls Electric Light and Power Company: Electric lighting and electric power for motors.

By-Products Paper Company: Manufacturers of fine grade papers, making large shipments of raw material from the Northwest.

The Carborundum Company: The only manufacturers in the United States of carborundum, using 2,000 electrical horsepower continuously in its production, and now about to double its capacity.

Carter-Crume Company (Limited): The largest manufacturers in the United States of blank sales tickets, stubs, manifold order blanks, etc.

Castner Electrolytic Alkali Company: One of the largest manufacturers in the world of caustic soda and bleaching powder.

Cataract Hair-Cloth Company: Manufacturers of haircloth.

Cataract Ice Company: Artificial ice.

Cataract City Milling Company: Flour; capacity, 1,000 barrels daily.

Central Machine Company: Machinists.

Central Screen Plate Works: Screens.

Cliff Paper Company: Newspaper and wood pulp; daily capacity, 30 tons of paper and 30 tons of pulp.

The Composite Board Company: Manufacturers on a large scale of composite board from sulphite.

J. H. Cook & Co.: Lumber yard and planing mill.

Doran Bros. & Martin Company: Suspenders.

Dobbie Foundry and Machine Company: Manufacturers of heavy forging, tanks, boilers, and structural work; general machine shop and foundry.

Electrical Lead Reduction Company: Engaged in reducing lead ore in electrical furnaces.

Electro Gas Company: Packers of calcium carbide and manufacturers of acetylene gas lamps.

The Ferro-Titanium Company: Ferro-titanium alloy.

Francis Hook and Eye and Fastener Company: Large manufacturers of hooks and eyes, snap fasteners, novelties, and machinery for making the same.

Frontier Brick Works: Clay brick.

Charlotte Haeberle: Lumber yards and planing mills.

Hinds Paper Box Company: Manufacturers of paper boxes.

International Paper Company: Manufacturers of wood pulp, sulphites, and newspaper; daily capacity of newspaper, 120 tons.

International Acheson Graphite Company: Manufacturers of chemically pure graphite; use continuously 1,000 electrical horsepower; produced in 1901, 1,000 tons of product.

MacPherson Switch and Frog Company: Large manufacturers of railway switches and general railway supplies.

Thomas E. McGarigle: Machinist and general foundry.

McLoughlin Malt House: Maltsters.

Metal Stamping Company.

Myers & Co.: Cattle spice mills.

National Electrolytic Company: Manufacturers of chlorate of potash.

The Natural Food Company: Manufacturers of shreddred whole wheat biscuit, shipping in about —— bushels of wheat per month and shipping out —— carloads per month.

Niagara Electro Chemical Company: A very large producer of sodium; about to treble their capacity.

Niagara Falls Acetylene Gas Machine Company: Acetylene gas machines.

Niagara Falls Brewing Company: Brewers.

Niagara Falls Distilling and Chemical Company: Distillers of vegetable oils.

Niagara Falls Gas and Electric Light Company: Illuminating gas.

Niagara Falls Hair-Cloth Works: Manufacturers of haircloth.

Niagara Falls Hydraulic Power and Manufacturing Company: Generates about 35,000 electrical horsepower for manufacturing purposes, and now engaged in largely increasing capacity.

Niagara Falls Milling Company: Two large flour mills; daily capacity, 2,000 barrels each.

The Niagara Falls Power Company: Generates 50,000 electrical horsepower for distribution and use in Niagara Falls and vicinity; plant now being extended for generation of 55,000 additional electrical horsepower.

The Niagara Falls Water Works Company: Supplying filtered water to city.

Niagara Silverware Company: Output about 50,000 spoons daily; silver-plated ware.

Niagara Surface Coating Company: Manufacturers of glazed plated paper and box board.

Norton Emery Wheel Company: Manufacturers, at Niagara Falls plant, of abrasives by electrical process.

Oldbury Electro Chemical Company: Very large manufacturers of phosphorus and its compounds.

Oneida Community (Limited): Manufacturers of silver-plated ware; output, about 50,000 spoons daily.

Pettebone-Cataract Paper Company: Newspaper and ground wood pulp; capacity, 25 tons of paper and 16 tons of pulp daily.

Philpot & Leuppie: Wire stitching machinery for bookbinders.

The Pittsburg Reduction Company: The only producers in the United States of the metal aluminum, using continuously twenty-four hours in the day from 8,000 to 10,000 electrical horsepower.

Roberts Chemical Company: Manufacturers of hydrochloric acid and caustic potash.

Wm. A. Rogers (Limited): Silver-plated articles.

Spencer-Wicker Lumber Company: Lumber yard and planing mill.

Carl Steinbrenner: Lumber yards and planing mill.

Union Carbide Company: The largest producers in the world of carbide of calcium; uses continuously about 12,000 electrical horsepower.

The United Barium Company: The largest producers in the United States of barium hydrite and other compounds of barium.

## NORTH TONAWANDA AND TONAWANDA.

These two towns, on each side of the Erie Canal, where it first connects with the Niagara River, are in different counties and can not well be merged into one municipality. The two make an important center of population, commerce, and industry, which would be greatly benefited by the work proposed.

The following are the commercial statistics of the water-borne commerce of the Tonawandas for 1901, as furnished by the board of trade of North Tonawanda.

| | |
|---|---|
| Number of coastwise vessels entering this port | 891 |
| Number of foreign | 87 |
| Total number entering | 978 |
| Number of coastwise vessels clearing from this port | 920 |
| Number of foreign | 81 |
| Total number clearing from this port | 1,001 |
| Tonnage of coastwise vessels entering this port | 503,542 |
| Tonnage of foreign vessels entering this port | 31,769 |
| Making a total tonnage of boats entering this port | 535,311 |

| | |
|---|---|
| Tonnage of coastwise vessels clearing from this port | 510,994 |
| Tonnage of foreign vessels clearing | 30,060 |
| Total tonnage of vessels clearing | 541,054 |
| Total tonnage of vessels arriving and leaving | 1,076,365 |

The merchandise received is as follows:

| | | |
|---|---|---|
| Lumber | feet | 451,596,420 |
| Shingles | pieces | 16,821,750 |
| Lath | do | 3,394,050 |
| Posts | do | 222,405 |
| Telephone poles | do | 1,216 |
| Railroad ties | do | 275,285 |
| Iron ore | tons | 255,088 |
| Pig iron | do | 522 |
| Limestone | do | 698 |

All of this business passes up and down the Niagara River, through the rapids and shoals at its head, in spite of these handicaps, and all would be immensely benefited by the proposed improvement.

In sending these statistics the secretary of the board states as follows:

> Statistics that we furnish you now must necessarily be incomplete from the fact that other industries are being added to our number. One in particular, the Tonawanda Board and Paper Company, capitalized at $600,000, has just begun building on the river front, and will be vitally interested in the improvement of shipping conditions on the Niagara River. These statistics are somewhat inadequate also from the fact that the boats of deepest draft do not enter Niagara River, and these parts are cut off from the traffic that would come this way if conditions were more favorable.
>
> There are millions of dollars invested in the different lines of manufacturing here that are wholly or largely dependent upon being able to receive freight by water from the upper lake regions. These are growing yearly in importance, and others are being added, which makes the need of better conditions in Niagara River increasingly urgent.

The following list of firms at North Tonawanda, Niagara County, interested in the proposed canal around the shoals and rapids at the head of the Niagara River, with their commercial rating, is also furnished by the board of trade of North Tonawanda:

| | Commercial rating. |
|---|---|
| Tonawanda Iron and Steel Company | $1,000,000 |
| W. H. Sawyer Lumber Company | 400,000 |
| Robinson Brothers Lumber Company | 300,000 |
| Robertson & Doeber | 50,000 |
| Smith, Fasset & Co | 1,000,000 |
| White, Rider & Frost Lumber Company | 150,000 |
| Silver, Thorn & Co., lumber | 400,000 |
| The Island Box Company | 150,000 |
| Fenton & Spalding Box Company | 100,000 |
| McLean Brothers, lumber | 150,000 |
| Dodge & Bliss Box Company | 100,000 |
| C. E. & W. E. Kelsey, lumber | 20,000 |
| R. T. Jones Lumber Company | 400,000 |
| Weston & Son, lumber | 1,000,000 |
| Oil & McKeen, lumber | 35,000 |
| Lee & Lentz, lumber | 10,000 |
| Lefaiver & Co | 50,000 |
| White, Gratwick & Co., lumber | 150,000 |
| J. & T. Charlton | 500,000 |
| W. G. Palmer, lumber | 20,000 |
| Thompson, Hubman & Fisher, lumber | 100,000 |
| Buffalo Bolt Company | 400,000 |
| Niagara Radiator Company | 75,000 |
| Buffalo Steam Pump Company | 100,000 |
| The American District Steam Company | 400,000 |
| Herschell-Spillman Company | 10,000 |
| C. G. Butts & Co | 20,000 |
| Total financial capital interested | 6,090,000 |

The firms in Tonawanda, Erie County, which would be so benefite are:

| | Commercial ratin |
|---|---|
| The Eastern Lumber Company | $1,000,00 |
| Fasset & Bellinger | 10,00 |
| F. I. Alliger | 50,00 |
| H. M. Loud's Sons Lumber Company | 250,00 |
| Tonawanda Board and Paper Company | 600,00 |
| The Gillie Engine and Machine Company | 35,00 |
| The American Boiler Works | 20,00 |
| Total capital interested | 1,965,00 |
| Grand total in both Tonawandas | 8,055,00 |

### BLACK ROCK.

Black Rock is part of Buffalo, and it is impracticable to entirely an satisfactorily separate its commercial statistics from those of Buffalo

The following firms, with their commercial rating and the amount o their business on the lake and river, indicate, approximately, the immediate benefits to come to Black Rock from the improvement proposed

| Name. | Commercial rating. | Lumber, etc. |
|---|---|---|
| | | *Feet B. M.* |
| Holland, Graves, Mambert & Co | $50,000 | 40,000,00 |
| Loud Sons Co | 250,000 | 30,000,00 |
| C. M. Betts & Co | 200,000 | 20,000,00 |
| T. Sullivan & Co | 20,000 | 3,000,00 |
| Dohn, Fisher & Beyer | 200,000 | 2,500,00 |
| Plumer Mill Co | ........ | 2,000,00 |
| | | *Tons.* |
| Fox & Holloway (sand) | 100,000 | 15,00 |
| Carroll Bros. (sand) | 75,000 | 16,00 |
| Buffalo Smelting Works (sand) | 100,000 | 1,00 |
| Buffalo Smelting Works (copper mineral) | 100,000 | 40,00 |
| Total | 1,095,000 | ........ |

The registered tonnage of the boats engaged in Black Rock's lake commerce is about 500,000 tons for arrivals and departures. The boat vary in capacity up to about 3,000 tons. Two boats engaged are the *Flagg* and *Warner*, each having a registered tonnage of 3,062 tons. These boats are in the copper-carrying business, and are only able t bring down 2,900 net tons, but going up the lake they load with coal at Buffalo, and carry 4,000 net tons. It will therefore be seen that under existing conditions boats of a very moderate capacity like these are only able to bring down three-fourths of a cargo.

### CANAL COMMERCE.

The commerce of the Erie Canal would be directly benefited by th proposed improvement. With the improvement made the boat would not traverse the narrow canal between Buffalo and Tonawanda, but would take to the Niagara River and pass the rapid and shoals at its head through the projected canal and lock. Thi would be very beneficial. There is carried now yearly on the canal into and out of Buffalo about 1,000,000 tons of freight, although the canal is in an antiquated condition and there are many things which work to its disadvantage. With the new and enlarged canal proposed by the State of New York, this tonnage it is confidently believed will rapidly increase and in all probability soon reach 10,000,000 tons per annum.

The existing commercial tonnage to be benefited by the proposed improvement may therefore be stated as follows:

| | |
|---|---|
| Tonawanda, lake and river | 1,000,000 |
| Black Rock, lake and river | 500,000 |
| Canal | 1,000,000 |
| Total | 2,500,000 |

It should be noted, however, that while the existing commerce to be benefited by the proposed canal is of great magnitude, the prospective benefits would be far greater, and of absolute certainty.

### SURVEY.

Should this general project be approved, and surveys and estimates be ordered, it is believed that the sum of $2,500 will be required for this purpose.

Very respectfully, your obedient servant,

Thomas W. Symons,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[Third indorsement.]

U. S. Engineer Office, Eastern Division,
*New York City, October 27, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the views of the district engineer that the locality is worthy of improvement by the Government, and recommending that a survey be made for the purpose of determining the probable cost of the proposed channel.

S. M. Mansfield,
*Colonel, Corps of Engineers,*
*Division Engineer.*

[Fourth indorsement.]

Office Chief of Engineers, U. S. Army,
*November 3, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Fifth indorsement.]

Board of Engineers for Rivers and Harbors,
*Washington, D. C., December 4, 1902.*

Respectfully returned to the Chief of Engineers, United States Army. The Board of Engineers for Rivers and Harbors has considered the within report of Major Symons on the preliminary examination of Black Rock Harbor, New York.

In the opinion of the Board the commerce involved is so large and of so general a character as to warrant an improvement of this locality by the General Government, provided such improvement can be made at reasonable cost.

It is believed that the construction of a lock and the removal of the embankment suggested herein will be in direct line with work that will probably be done hereafter with a view to regulating the level of Lake Erie. It is not believed desirable to undertake excavations at the head of the Niagara River with a view to providing for the commerce of the lower Niagara River, including Tonawanda, N. Y., as such excavations would doubtless tend to lower the level of Lake Erie.

The Board recommends that there be made an allotment of $2,500, as requested by the district officer, with which to make a survey and estimate of cost.

For the Board:
H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*December 6, 1902.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Black Rock Harbor, Buffalo, N. Y., authorized by the river and harbor act of June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Seventh indorsement.]

WAR DEPARTMENT,
*December 11, 1902.*

Approved, as recommended by the Chief of Engineers.

E. ROOT,
*Secretary of War.*

[Eighth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, October 19, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors, with report of survey and estimate as recommended.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Ninth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 22, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

In the accompanying report of the district officer upon a survey of

Black Rock Harbor, New York, which has been reviewed by the Board of Engineers for Rivers and Harbors, an estimate of cost is submitted for a proposed ship canal and lock, navigable for the largest lake carriers, connecting Lake Erie with Niagara River at a point below the shoals which exist near the entrance to the latter. The estimate of cost is $3,473,239. The walls of the lock proposed by the district officer consist largely of timber cribs, rock filled. The Board realizes that the greatest economy has been sought in the lock design, but is unable to concur in the proposed use of timber cribs to the extent shown in the drawings accompanying the report. In response to a query from the Board the district officer has furnished a memorandum, from which it appears that $380,000 should be added to the estimate above stated in order to provide concrete lock walls throughout.

The plan of improvement submitted does not include the improvement of the east channel of Niagara River from the foot of the proposed ship lock to the head of the natural deep-water harbor, 2½ miles downstream. The district officer states that approximately $500,000 would be required for this work, but that exact data are not at hand. Such work would be necessary to lend to the proposed improvement its full value, and should in fact be considered a part thereof, although it falls outside what is generally known as Black Rock Harbor.

For reasons above stated the Board believes that at least $4,500,000 would be required to complete the improvement.

The benefits that would result may be summed up as follows:

(*a*) For the commerce of Tonawanda and vicinity there would be provided a channel suited for the deepest lake vessels, in lieu of one with an available depth of but 14 feet. The annual tonnage of vessels in and out of Tonawanda is reported at about 1,000,000. Great manufacturing developments are in progress between Buffalo and Niagara Falls. Commerce between Niagara River and lake ports may be expected largely to increase.

(*b*) The projected 1,000-ton New York State barge canal is designed to terminate at Tonawanda, although it is intended to preserve the existing Erie Canal between Tonawanda and Buffalo as a feeder. The Black Rock Harbor improvement would be available for deep-draft vessels as well as for barges, and transshipments might be effected at Buffalo, Tonawanda, or any intermediate point.

(*c*) As the proposed channel is close to the shore throughout, additional wharf property would be provided for Buffalo.

(*d*) If the proposed channel and lock were provided, works to regulate the lake level might be constructed at the entrance to the Niagara River without shutting off the latter from lake navigation.

Considering the great cost of the proposed improvement, the Board believes that only commercial benefits of the greatest magnitude could justify its undertaking. Benefits to the commerce of Tonawanda and vicinity and increased harbor facilities at Buffalo are not under existing conditions sufficient reasons for so large an expenditure. There has already been appropriated for the improvement of Buffalo Harbor approximately $5,500,000, and the resulting facilities, so far as they are usually provided by the United States, are well ahead of the needs of commerce. Were the barge canal completed to-day, the proposed improvement would be a desirable adjunct thereto. But it is believed that the Black Rock Harbor work might be begun several years hence, and prosecuted at an economical rate to completion before the barge canal will be finished. The Board expresses no opinion as to the propriety of the United States undertaking any link of or adjunct to the State barge canal, though it recognizes the benefit to the commerce between the States, due to the construction of this canal.

After giving the most careful consideration to the questions involved, the Board recommends that it is not advisable to commence at the present time the improvement of "Black Rock Harbor, with a view to obtaining a suitable channel for deep-draft vessels around the rapids and shoals at the head of the Niagara River."

For the Board:

A. M. MILLER,
*Lieut. Col., Corps of Engineers,*
*Senior Member Present.*

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## SURVEY OF BLACK ROCK HARBOR, NEW YORK, AROUND THE RAPIDS AND SHOALS AT THE HEAD OF NIAGARA RIVER.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., September 29, 1903.*

GENERAL: I have the honor to submit the following report on a survey and estimate of cost of improving—

Black Rock Harbor, with a view to obtaining a suitable channel for deep-draft vessels around the rapids and shoals at the head of the Niagara River.

in conformity with the instructions contained in Department letter of December 13, 1902.

The object of this survey is to obtain all necessary data for making plans and estimating the cost of a ship canal or waterway suitable for the large vessels navigating the Great Lakes through Black Rock Harbor from its head, where it joins Lake Erie, to its lower end, at the foot of Squaw Island, where Black Rock Harbor joins the Niagara River below the engorged section having swift currents and shoals which render that section of the river unnavigable, except for the smaller lake vessels of a draft not exceeding 15 feet at mean river level.

A report on a preliminary examination of this proposed improvement was made by Maj. T. W. Symons, Corps of Engineers, United States Army, October 1, 1902, in which is given in extenso a description of the locality, accompanied by a map of Buffalo Harbor and Niagara River to the Falls, arguments as to the worthiness of the contemplated improvement, and, in a general way, the proposed plan of improvement.

These matters are so fully treated in the report on the preliminary examination that further remarks thereon are not considered necessary.

The proposed plan of improvement, as stated in the report on the preliminary examination, is as follows:

> The proposed plan of improvement is to widen Black Rock Harbor to its original width by removing the wall that separates it from the Erie Canal, which once formed a part of it, thus making it from 250 to 500 feet wide, instead of about 125 feet wide as at present; the resultant waterway then to be deepened sufficiently to accommodate the largest vessels of the Lakes, with a lock at its downstream end sufficient to overcome the fall of the river. The lift of the lock would be about 5 feet, and it would be situated near the lower end of Squaw Island, in a position convenient of access by vessels navigating either channel of the river below the shoals and rapids. This canal and lock will enable all vessels, of whatever draft or width engaged in lake commerce, to pass from Lake Erie into the splendid natural harbor of the Niagara River below the shoals and rapids at its head.

The survey and estimates of cost treated in this report were made in conformity with the above-quoted proposed plan, which is the only plan by which the desired object could be accomplished.

It may be related here, however, that the improved waterway through Black Rock Harbor, with the proposed ship lock at its lower end connecting it with Niagara River, would not fully complete the improvement and "enable all vessels' of whatever draft or width engaged in lake commerce, to pass from Lake Erie into the splendid natural harbor of the Niagara River below the shoals and rapids at its head." This natural deep harbor begins about 2½ miles below the proposed lock and extends thence for over 6 miles to Tonawanda, N. Y. The depth in the intervening stretch of 2½ miles ranges from 18 to 20 feet at mean river level, and included in this stretch is the Strawberry Island reef, a limestone rock ledge, through which the channel has been excavated 400 feet wide and 18 feet deep at mean river level. To make the natural deep harbor fully available to the deep-draft vessels of the lakes, a draft of 18 to 20 feet, there would be required a further deepening of about 1¾ miles out of the 2½ miles of river from 1 to 5 feet for a navigable width of channel 400 feet. This channel must be considered in a full discussion and plans for improvement to fully gain the object sought by the ship canal in connection with the latter. The channel is therefore briefly considered in this report hereinafter, but separately from the Black Rock Harbor ship channel and the estimates therefor.

## SURVEY.

In order to secure the required physical data, all existing survey records and maps of the locality were first collected and examined and then the additional data required was obtained by actual survey work.

The sources of existing data were the records and maps of the State engineer and surveyor of New York, the State having originally constructed and always maintained the Erie Canal and Black Rock Harbor; the records and maps and reports of the United States Board of Engineers on Deep Waterways between the Great Lakes and the Atlantic Tide Waters (House Doc. No. 149, 56th Cong., 2d sess.), and the records and maps on file in the United States engineer office, Buffalo, N. Y.

The data thus obtained required amplification and checking of locations and distances, and was lacking in an exact determination of rock surface along the line of the proposed ship canal. A survey party was organized in February, 1903, and the required locations determined by transit survey. At the same time a sounding party was engaged in sounding cross sections of the Erie Canal-Black Rock Harbor waterway, and in determining the elevation of rock surfaces underlying it by means of test rods driven to rock with sledges or sunk with a water jet, as conditions required. These parties were in the field until April, 1903, much of the rock-testing work having been done through the ice under more favorable conditions than could have been secured by operating in open water.

The determination of the rock surface in the vicinity of the proposed lock was a matter of importance. Such determination could not be made with the ordinary methods employed, and many trials with a steam pump to supply a powerful water jet failed in forcing a test rod to rock in this locality, where the bed rock lies about 40 feet under water surface and is overlaid by about 15 feet of gravel and sand, and in places quicksand; all too hard to penetrate with a water jet.

An agreement was therefore entered into with parties having a steam well-drilling outfit to drill five test holes to rock along the shore of Squaw Island, adjacent to the location of the proposed ship lock. This outfit began drilling on June 10, 1903, and completed the required five test holes to rock on June 27, 1903. These test holes were drilled through the sand and gravel with some difficulty, owing to the fine sand or quicksand packing hard under the drill, and all of the holes required casing throughout, but in each case the bed rock was reliably determined. Two hundred linear feet of 4½-inch test holes were drilled at a cost of $2 per linear foot.

In connection with the general survey work, measurements and cross sections of the Bird Island pier and the wall separating the Erie Canal and Black Rock Harbor were made, details of their construction, and details relating to existing bridges, the waterworks tunnel and trunk sewer underlying the waterway, and many other minor details were examined into and information relating thereto gathered.

There is submitted herewith a map[a] of the locality, compiled from the several sources of information before mentioned, as checked and modified by the survey made. The location of the proposed ship canal and lock is also shown on the map. There are also submitted herewith a map[a] showing, on a larger scale, the lower end of the proposed ship canal, upon which certain details of location of lock, the location of borings at the proposed lock, depths to rock, etc., are indicated, and also a drawing[a] showing cross sections of the proposed ship canal prisms, of existing structures, etc.

### THE PROPOSED SHIP CHANNEL.

The desired channel for deep-draft vessels implies:

(*a*) The excavation of this channel of proper width and depth and alignment through Black Rock Harbor.

(*b*) The construction of a ship lock of proper dimensions at the lower end of the Black Rock Harbor channel to overcome the fall of Niagara River and to connect this channel with Niagara River below the shoals and rapids at the head thereof.

The improvement of the east channel of Niagara River where required, from the foot of the ship lock to the head of the natural deep-water harbor, 2½ miles downstream, is not a part of the survey and estimate called for under the title.

The location and dimensions of the proposed channel are shown on the general map[a] herewith. The improvement would begin at the southerly end of the Bird Island pier, where the ship channel would join the basin now being excavated, 500 feet wide and 23 feet deep at mean lake level, under the existing project for "improving Lake Erie entrance to Black Rock Harbor and Erie Basin."

This project provides for a channel way from the main entrance to Buffalo Harbor, between the north breakwater and the old breakwater, to the point of beginning of the proposed Black Rock Harbor channel, as shown on the map[a] herewith.

All of the channels and basin under the project for improving Lake

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[a] Not printed.

Erie entrance to Black Rock Harbor and Erie Basin are now being excavated to 23 feet depth at mean lake level, under a continuous contract to be completed by December, 1906.

This improvement will secure an ample channel, well protected and navigable by the largest lake vessels, as an entrance to the waterway herein considered, from Lake Erie.

From the point of beginning, at the end of Bird Island pier, the ship channel would extend northerly through Black Rock Harbor on the following alignment:

| | Feet. |
|---|---|
| Straight channel | 1,250 |
| On 2-degree curve | 2,500 |
| Straight channel to waterworks bend | 3,250 |
| Straight channel to Ferry street | 2,670 |
| On 2-degree curve | 730 |
| Straight channel | 2,100 |
| On 1-degree curve | 1,400 |
| On 2-degree curve to 100 feet below International Bridge | 2,100 |
| Straight channel to lock at station 171 | 1,100 |
| Total length to lock | 17,100 |

*Channel prism.*—The bottom width of the channel way has been taken at 200 feet, as shown on the standard cross sections of the channel prism on the drawing[a] herewith.

This width of cross section is adapted to steam vessels traveling at the rate of 5 to 6 miles per hour, which speed is ample for the economical transportation of lake traffic and could be safely maintained, except, perhaps, on the curves, without danger to passing vessels or damage to the channel banks.

It is probable that widening of the channel in the curves would be necessary, and allowance therefor has been considered to the extent advisable in the limited width available. According to the formula usually employed for increased width in curves, the width at the apex of the 2-degree curves would be increased 40 feet, 20 feet on each side, and at the apex of the 1-degree curve, 20 feet, 10 feet on each side. This increase of width would in this instance involve only a small amount of excavation over that required for the standard prism.

*Canal wall.*—For 1 mile from the upper end, the ship channel would be excavated in the present clear waterway of Black Rock Harbor. Then the canal wall separating Black Rock Harbor and the Erie Canal would be reached, and, in order to secure the required width of channel, this wall must be removed. It extends thence practically the entire length of the proposed channel, as shown on the map[a] herewith. It is composed of timber cribs resting on the natural bottom, at the general depth of 10 feet at mean lake level, and reaching up to water surface, surmounted by a superstructure of dry stone wall, in some places of earth and stone, 2 to 6 feet high.

Its removal could be readily effected in the process of ordinary dredging, after the larger stone in the superstructure had been removed by derricks.

The removal of this wall would in no way affect or injure the Erie Canal, as the water level of the two bodies of water, Black Rock Harbor and the Erie Canal, is at all times the same. This wall is, in fact, a relic of construction in the early days of the Erie Canal, long since rendered unessential by other constructions and improvements.

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[a] Not printed.

The removal of this wall, as well as the occupation of Black Rock Harbor and the Erie Canal for the proposed larger waterway, would require the sanction of the State of New York, probably by legislative enactment. This matter is considered further on in this report.

*Waterworks tunnels.*—At station 70, the Buffalo waterworks are located on the mainland side of the waterway, and from these works three tunnels lead under the Erie Canal and Black Rock Harbor to the inlet crib in Niagara River. The location is shown on the map herewith.

These tunnels are known as the 4-foot tunnel, the 6-foot tunnel, and the 9-foot tunnel, their respective diameters being 4, 6, and 9 feet. The three tunnels are cut in limestone rock and are not lined. They are separated horizontally by walls of bed rock about 22 feet thick, but lie in different horizontal planes. The uppermost is the 4-foot tunnel, the top of which lies 5 feet below the bottom of the proposed ship channel, 23 feet deep at mean level. The top of the 6-foot tunnel lies 16 feet below the bottom of the proposed ship canal, 23 feet deep at mean level, and the top of the 9-foot tunnel lies 28 feet below the bottom of the proposed channel. The 4-foot tunnel is not used, and is understood to be abandoned.

The channel excavation at this point would be entirely in limestone rock and the removal of rock to the required depth would probably injure the 4-foot tunnel roof, so that it would leak and thus be rendered useless for waterworks service; but as it has already been abandoned. such injury would be admissible and unimportant. The 6-foot and 9-foot tunnels lie at a safe depth, and the channel excavation would not injure them if done with proper care.

It is, therefore, not considered necessary to make any provision for the repair of injury to the waterworks tunnels.

*The trunk sewer.*—At station 90, at the foot of Albany street, a large trunk sewer, one of the most important in the sewer system of the city of Buffalo, is met with. This trunk sewer is circular, 8 feet inside diameter and at Albany street dips down under the existing Erie Canal-Black Rock Harbor waterway, and empties into the Niagara River under Bird Island pier. The sewer crosses the waterway diagonally on a curve and, from the beginning of the invert at Albany street to the outlet under Bird Island pier, it is 500 feet long.

The sewer lies below rock level except at the outlet, where the top lies several feet above rock level, and the bottom in rock; so that the bottom of the sewer is about on the level of the bottom of Niagara River and about 23 feet below the water surface of the river at its mean level.

The excavation of the proposed ship channel to the depth of 23 feet at mean lake level would destroy the trunk sewer invert under the waterway, as the top of the sewer lies only 16 feet below mean lake level and the bottom only 24 feet below.

Reconstruction of the sewer would therefore be necessary for about 500 linear feet, with the top of the new structure at least 24 feet below mean level. This would carry the bottom of the sewer to the depth of 32 feet, which is 6 feet below the bottom of Niagara River at this point.

There would therefore be required a basin excavated in the rock bottom of the river at the sewer outlet to the depth of at least 32 feet, so that the sewer could discharge into the river waters. This basin should be at least 50 feet square, and would require the removal of 8 feet of bed rock over this area.

The reconstruction of the sewer at the lower level would involve a considerable cost. The work must be done in the open, implying not only the construction of a cofferdam inclosing the sewer inside of the Bird Island pier, but also a cofferdam in Niagara River around the sewer outlet, for the reconstruction of the pier at the outlet. The cost would probably reach $100,000.

It is possible that the problem might be ultimately solved in another way involving little or no cost. It is expected that the 1,000-ton barge canal to be built by the State of New York will be authorized by the vote of the people of the State in November. The plans for that canal make Tonawanda its terminus, but provide that the present Erie Canal from Buffalo to Tonawanda shall be maintained. This portion of the canal would, however, be little used by 1,000-ton barges, and in any event a mild current through this canal would not be objectionable. This current could be created by a spillway at Tonawanda, drawing and discharging a moderate amount of the canal waters into Niagara River. Under these conditions the discharge of the trunk sewer at Albany street, Buffalo, could be made into the ship channel and all reconstruction of the sewer under that waterway avoided.

The solution of the trunk-sewer problem can not, however, be made at the present time. It involves consideration and action on the part of the city councils and department of public works, which can only be secured under the laws governing their deliberations after the submission to them of a definite plan of reconstruction. The provision made herein is considered ample for any required reconstruction of the trunk sewer.

*Ferry Street Bridge.*—At station 98 the Ferry Street Bridge crosses the present waterway, and conditions require the maintenance of a highway bridge at this point over the proposed ship channel, this bridge being the only means of reaching the established ferry between Buffalo and Fort Erie in Canada.

The present structure is really two bridges—a through truss highway bridge over the Erie Canal from the mainland to an abutment built in the canal wall, and a center pivot swing bridge across Black Rock Harbor from the abutment to the Bird Island pier and ferry landing. The foot and wagon traffic over this bridge is large.

The excavation of the proposed ship canal necessitates the removal of the canal wall and abutment, and the navigation of the proposed ship channel by large lake vessels implies the construction of a bridge at this point affording a clear waterway of at least 150 feet width. This can only be accomplished by a lift bridge, preferably the two-leaf type, each of about 75 feet clear span.

The present bridge is owned and operated by the New York State canal department, and as the United States would practically assume the ownership of the present State waterways in this locality (the Erie Canal and Black Rock Harbor) in the construction of the ship channel, the construction of the new bridge would devolve upon the United States.

The matter of constructing a suitable lift bridge at Ferry street was taken up with the Scherzer Rolling Lift Bridge Company, Chicago, Ill., and the cost of such a structure arrived at by plans and estimates courteously furnished by that company under specifications furnished them. The cost of a two-leaf lift bridge complete, with clear channel way of 150 feet, would be $70,000.

The cost of a two-leaf lift bridge, with a clear channel way of 200 feet, would be $105,000. The designs call for a roadway 20 feet wide, and a footwalk on each side 5 feet wide.

*International Bridge.*—At station 159 the International Bridge crosses the Erie Canal-Black Rock Harbor waterway. This is a single-track railroad bridge owned and operated by the International Bridge Company, a corporation allied to the Grand Trunk Railway. The bridge is used by the latter railway, and also by the Michigan Central and Wabash railways. This bridge is composed of two parts, the main part being that across Niagara River from the Canadian shore to Squaw Island, and the other part, that under consideration, from Squaw Island to the American mainland.

In this part of the bridge there is a center pivot swing span, with a clear draw opening of 70 feet on the west side of the center pier and of 90 feet on the east side. The present depth of water in the west draw opening, which is the side always used by vessels, is about 10 feet; the depth in the east draw opening is about 8 feet.

According to the drawings of the bridge, the abutments and two piers in the waterway are founded on piles driven to about 30 feet below mean-water level, or only 20 to 25 feet in the sand and gravel bottom. The pile foundation reaches to the level of the bottom, and upon it are founded timber cribs reaching to low-water level.

The timber cribs are surmounted by masonry piers upon which the bridge trusses rest.

The excavation of the proposed ship channel to the depth of 23 feet would require the removal of the pivot pier and swing span, and preferably the construction of a lift bridge with not less than 150 feet clear waterway in place of the present swing span. The conditions are favorable for such a construction, as the west abutment and the pier east of the swing span are well located to form, with proper strengthening, the necessary abutments for a two-leaf lift bridge with 150 feet clear waterway.

The present draw openings 70 and 90 feet wide would pass the largest lake vessels, provided the channel could be excavated to the required depth of 23 feet between the existing piers. It is quite certain, however, that such excavation could not be done without weakening the pile pier foundations beyond the limit of safety; and, moreover, the clear span width of only 70 and 90 feet would engender difficult and dangerous navigation at a point where vessels would approach the ship lock, about 1,200 feet beyond the bridge, and where such difficult navigation must be avoided to the greatest possible extent.

Adequate and proper treatment to meet the requirements of the proposed ship channel would therefore require the substitution of a lift bridge, as above specified, for the present swing span.

The necessary changes in the International Bridge would devolve upon the owners of the bridge and not upon the United States, as provided by United States statutes, and as stipulated in a permit for reconstruction of this bridge, issued by the Acting Secretary of War, under date of March 29, 1899.

In this instrument occurs the following stipulation:

> 3. That if the Secretary of War shall hereafter deem it necessary or advisable that the portion of the bridge over Black Rock Harbor shall be remodeled or changed in any manner, such change shall be made by the owners of the bridge, or their assigns, at their own expense.

In conformity with the above, plans and cost for the necessary changes in the bridge are not considered in this report.

*Old ship lock and extension of high-level waterway.*—The new ship lock would be located at station 171, about 1,150 feet below the International Bridge, so as to secure a free approach to the lock of a suitable length to insure good mooring berths for large lake vessels when necessary to wait for lock passage. Within this length is located the existing ship lock, 200 feet long, 36 feet wide, with a depth of about 9 feet on the miter sills. This is a lock of the ordinary canal type of construction, with masonry walls and wooden gates operated by hand.

On the east side of the lock there is a filled-in area forming a dam, and also space for a lock keeper's dwelling, tool shed, etc. The excavation of the proposed ship channel would require the removal of this old ship lock and most of the filled-in area to the eastward of the lock, and also the construction of an extension of the dam about 550 feet northward to the new lock to carry the high-level channel to that point.

The extension of the dam would be constructed in permanent form of crib substructure, surmounted with a concrete superstructure, having a top width of 8 feet, supplied with mooring facilities for vessels waiting at the lock. The structure would be made water-tight by an embankment of clay along its outer face, properly protected against wash by heavy rains.

The old ship lock and the filled-in area adjoining it are Erie Canal property and should revert to the United States through the rights and title which must be obtained from the State of New York for the Erie Canal-Black Rock Harbor waterway. It is assumed that such rights and title would be acquired at no cost, or at a nominal cost allowed for further on, and the purchase of the old lock and adjacent property is therefore not considered in the estimate of cost as a separate item.

*Repair of canal-towpath wall and Bird Island pier.*—The proposed ship channel would be bounded for 8,500 feet of its length on the east side by the existing stone wall of the towpath of the Erie Canal. Where not so bounded, at the upper and lower ends, the boundary on the east side would be natural earth bank, requiring no construction for its repair and maintenance.

The wall of the towpath is generally in fair condition and the excavation of the ship channel is planned with a view to preserve its stability to the extent possible in the restricted width available for the new channel. It is assumed that the channel close to the towpath would continue to be used by canal boats and remain virtually a part of the Erie Canal system under State administration. This would imply the maintenance of the towpath and its wall by the State of New York, as at present. During the extensive excavation of this portion of the Erie Canal in 1899, when the depth was increased to 12 feet, several serious cave-ins of the towpath walls occurred and many thousands of dollars were expended in the repair of these cave-ins.

The liability to similar accidents must be taken into consideration in the plans and estimates of cost of the proposed ship channel.

There is another contingency requiring consideration. The edge of the deep ship channel above Ferry street, for about 1 mile of channel, would be 20 to 40 feet away from the towpath wall and 10 to 12 feet under water, which is the depth of the present canal. This edge of rock would seriously damage vessels if they should strike it, and it must be trimmed and beveled off so as to leave no sharp angles or a jagged edge.

The liabilities which might be incurred in wall cave-ins and the treatment of the rock edge are indeterminate. It is, however, considered necessary to allow $75,000 in the estimate of cost for those items. As above stated, it may be assumed that, after proper repair done to damage sustained during channel excavation, the maintenance of the canal-towpath wall would remain with the State of New York.

On the west side the proposed waterway would be bounded by the Bird Island pier for a length of 10,800 feet from its southerly end. For the remainder of its length to the ship lock the boundary would be the natural bank of Squaw Island—all as at present existing. The Bird Island pier should revert to the United States under the rights and title to be secured from the State of New York, and it is assumed that this pier would become the property of the United States. This would imply repair and maintenance of the pier by the United States; and repair would be necessary to some extent.

The southerly 3,100 feet of the pier (the Lake Erie end) is a timber-crib structure filled with stone and decked over with planking. It is heavily riprapped on the lake side. The deck is much decayed and practically gone.

The structure should be placed in permanent form by replacing the present old timber superstructure with one of concrete or stone. This would cost $60 per linear foot, or $18,600 in all.

In extension northward from the timber-crib portion the pier is composed of timber cribs surmounted above water level by a superstructure of rubblestone covered with large flagstones. It is in a practically permanent form, but no information is obtainable as to the depth at which the cribs are founded or whether they rest on rock or not.

The excavation of the ship channel would closely approach the pier structure at one point opposite the waterworks, and if the cribs are not founded upon rock at this point undermining of the pier is inevitable and repairs would be required.

At another point (station 42) the excavation would remove a part of the pier structure, and provision must be made for a new stretch of pier some 300 feet long to replace the part which will necessarily be destroyed. This must be built farther out in the river and proper joints made with the existing pier to preserve the structure as a dam holding the waterway to the level of Lake Erie. The new construction required would be 300 linear feet of cribwork, 18 feet wide and 16 feet high, sunk on the rock bottom of the river and surmounted by a stone superstructure similar to that on the present work. This would cost $50 per linear foot, or $15,000.

The deep excavation would further be liable to cause leaks in the pier, which, while indeterminate, must be fairly allowed for, and allowance must also be made for general repairs to the stone superstructure and the closing of an old water-power flume below Ferry street.

All of these items, definite and indefinite, must be covered by a safe estimate of cost, which can not be placed at less than $75,000.

*Squaw Island embankment.*—The Bird Island pier reaches the head of Squaw Island at about station 108, and thence northerly the water level of the Erie Canal-Black Rock Harbor waterway is preserved by an embankment or levee along the low shore of Squaw Island to the present ship lock. This embankment is in good condition and would require no repairs. The extension of the high-level channel, under the plans for the ship channel and lock, would require the extension of the embankment or levee along the shore of the island, from the foot of the old lock to the wing wall at the head of the new lock, a distance of 500 feet.

This embankment should reach to the elevation of at least 8 feet above mean lake level, with a top width of 12 feet with natural slopes. It could readily be built with the gravel and clay excavated from the adjacent channel excavation, and in connection therewith, at a cost not exceeding $3,000.

*Channel excavation.*—Under the foregoing headings all of the alterations, repairs, and improvements of existing structures and works, from Lake Erie to the proposed new ship lock, required to adapt them to the enlarged and deepened waterway, have been considered.

There yet remains to consider the excavation of the channel prism to the proposed lock. As previously stated, the ship channel is designed to be 200 feet wide, for reasons given.

The depth of the channel adopted is 23 feet at mean lake level, or the level of the Black Rock Harbor-Erie Canal waterway.

This depth is adopted because it is the depth established for all improvements of navigation for the deepest draft vessels at Buffalo Harbor. The fluctuation of water level, due to ordinary winds and other ordinary causes, at the Buffalo end of Lake Erie, ranges from 3 feet below mean level to 3 feet above that level. The maximum fluctuation due to high winds ranges from 5 feet below mean level to 8 feet above that level. These maxima are, however, of infrequent occurrence and need not be considered in this connection. The maximum draft of vessels on the Great Lakes must now be taken at approximately 21 feet and the draft of the class of large vessels generally, excepting those of extreme size and draft, as 18 to 19 feet.

This is well shown in the following excerpts from articles on "Lake Cargo Records," published in The Marine Review, Cleveland, Ohio, August 6 and 13, 1903:

> The *William Edenborn*, of the Pittsburg Steamship Company, on August 1, 1903, smashed her own record, and, of course, all other records besides, in moving from Escanaba to South Chicago 8,807 gross tons, or 9,864 net tons, of iron ore. With this cargo she drew 20 feet 9 inches aft and 20 feet 5 inches forward.
>
> *The Manila*, of the Pittsburg Steamship Company, carried 7,820 gross, or 8,758 net tons, of ore on even draft of 18 feet 10½ inches.

The *Manila*, while a tow barge, typifies the class of large lake vessels (both steam and barge) ranging from 420 to 470 feet in length over all, with a beam of 50 feet—the typical large modern vessels on the Great Lakes.

The draft of 19 feet may be taken as the ruling draft of this typical deep-draft vessel. The channel 23 feet deep at mean level would have a depth at low water of 3 feet less, or 20 feet. It is desirable and advisable for safe navigation to have at least 1 foot of water under a vessel's keel at all times; so the low-water depth of 20 feet would fully meet the conditions required for fair navigation for the typical large deep-draft lake vessel under all but extraordinary low-water conditions, which occur at infrequent intervals of a few hours each.

The channel would also be navigable, except under low-water conditions, lower than 2 feet below mean level (which do not prevail except during a part of the seasons of low water in the Great Lakes) for the four large vessels of the *Edenborn* type, known as the "big four." These vessels are 498 feet long over all, with 52 feet beam and, when fully loaded, of about 21 feet draft.

The quantities of materials to be removed to secure the adopted channel dimensions, viz, 200 feet wide in straight channel as heretofore stated, was determined from cross sections 100 feet apart for the entire length of the proposed ship channel to the new lock. Typical cross sections in earth, earth and rock, and all rock are shown on the drawing[a] herewith. From the Lake Erie end to station 40 the material to be removed is earth and rock, the rock lying generally at a depth of 14 to 16 feet, overlaid by a bed of sand, mud, and gravel, generally 7 feet deep. At station 40 the rock level rises to about 12 feet depth, and continues generally at this depth to Ferry street, station 98. The rock is overlaid by a bed of sand, mud, and gravel, generally 4 feet deep in Black Rock Harbor, while the rock is generally bare in the Erie Canal. At Ferry street the rock begins to dip down rapidly, and is generally confined to the easterly half of the proposed ship channel to station 132, where the rock lies entirely below grade, and is not met with again thence to the proposed ship lock at station 171.

All of the materials overlying rock can be readily removed by an ordinary dredge. The rock is limestone of moderate hardness, which will require drilling and blasting, and dredging of the blasted rock.

Before the general excavation can be done it will be necessary to remove the old wall, heretofore described, between Black Rock Harbor and the Erie Canal, from station 55 to station 150—9,500 linear feet.

The large stone incorporated in the superstructure of this wall should be removed with derricks. The small stone and earth in this superstructure, together with the underlying cribs, can be removed by the dredges, together with the general excavation of earth. In the estimate of cost herewith, however, the removal of the wall is estimated as a separate item, at a rate per linear foot of wall.

It is assumed that all of the excavation would be done "in the wet" by floating plant.

Much of the excavated rock can be utilized in the new construction in and about the new ship lock, as foundation stone, filling for dam walls, and for crib work. The surplus and most of the excavated earth would have to be disposed of on designated dump grounds in Niagara River, below the ship lock.

Below the proposed ship lock the depth of the present channel in lower Black Rock Harbor is only 9 feet at the upper end, gradually increasing until the main river channel, 18 feet or more deep, is reached at the foot of Hertel avenue. This channel way is about 1,500 feet long, and it must be deepened before the new waterway can be used by loaded vessels.

This channel should be 400 feet wide to conform with the improved Niagara River channel, and it would be most advantageous and economical to excavate it to the full depth of 23 feet at mean river level at once, instead of to 18 feet only, to make it conform with the present channel across Strawberry Island reef. (See "remarks.")

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[a] Not printed.

The required excavation would all be in gravel and soft clay, and in the estimate of cost herewith there is included in "channel excavation" the removal of 250,000 cubic yards, place measure, of earth, to secure a channel through lower Black Rock Harbor from the foot of the proposed ship lock to Hertel avenue, 1,500 feet long, 400 feet wide, and 23 feet deep at mean river level.

*The ship lock.*—This lock must be of a size commensurate with the ship channel and adapted to the deep-draft vessels for which the waterway is designed. It is not considered necessary to enter into a detailed discussion of the question of size and design of lock. These have received full consideration, and the lock adopted and estimated for in this report is in conformity with good modern designs and practice as developed on canal systems connected with the Great Lakes.

The size of the lock would be 600 feet long between quoins by 60 feet clear width. The lift of the lock would be 4 to 6 feet, depending upon the relative fluctuations of water level in the ship canal (and Lake Erie) and in the Niagara River. The lift would be generally 5 feet.

The length and width of the lock are those which experience at Sault Ste. Marie has shown to be the most advisable for general traffic on the Great Lakes; and which, it is understood, would be adopted for a proposed new lock at that point.

The standard lock adopted by the United States Board of Engineers on Deep Waterways for the proposed ship canal, from the lakes to the sea, would be of similar dimensions. The classes of vessels using the Niagara waterway would be the same as those using the Sault locks, where the following classification was determined by actual experience:

The number of registered vessels using the canals and locks at Sault Ste. Marie, Michigan and Ontario, in 1902, in trade to and from Lake Superior, was:

| | |
|---|---|
| Vessels 400 to 500 feet long | 87 |
| Vessels 300 to 400 feet long | 179 |
| Vessels 200 to 300 feet long | 337 |
| Vessels 100 to 200 feet long | 248 |
| Vessels less than 100 feet long | 84 |

The 45 new vessels put into commission in 1902 for the Lake Superior trade were large steam freighters, varying from 225 to 436 feet in length, and designed for economical speed of 13 miles per hour on a draft of 19 to 21 feet.

It is now reported that a new type of lake vessel is to be introduced, and one vessel built during the winter of 1903-4, which will be 560 feet long over all, 56 feet beam, and 20 to 21 feet draft.

It is not probable that this new type will become general for many years to come, if ever; but should it become general the new lock would accommodate this new type.

The largest type of lake vessel at present is that represented by "the big four" previously mentioned, which are 498 feet long over all, with 52 feet beam.

The lock, 600 feet long, would accommodate all existing lake vessels, with a safe allowance for prospective increase in length. The width of 60 feet fulfills the same conditions, leaving out of consideration the few large side-wheel passenger steamers, which have a beam of 85 feet, and which would not use the Niagara waterway.

As shown by the table of vessels using the Sault Canal, the larger proportion are less than 400 feet long. The proposed lock is provided with intermediate gates dividing the lock into 400 and 200 foot lengths, which would be used for locking vessels to which these lengths are suitable.

The depth of water on the miter sills is designed to be 24 feet at mean level, which is considered necessary to insure the sills against damage by vessels striking them at low water, when the depth would be about 20 feet.

*Design and construction of ship lock.*—In the study of designs and construction of the lock, the data given for similar works in the report of the United States Board of Engineers on Deep Waterways has been largely consulted and, in general, their design of lock adopted, except as to foundations and special features adopted in the design of the Board to meet the conditions required by high lifts and consequent large hydraulic heads.

There is submitted herewith a drawing[a] showing the general design of the proposed ship lock, drawings of details being omitted.

The lift of the proposed lock would be only 4 to 6 feet; under conditions generally prevailing, 5 feet. This favorable feature eliminates many of the problems of construction encountered in locks of large lift and renders unnecessary consideration of the question of time of lockages. As before stated, the proposed lock would be 600 feet long between gates and 60 feet wide between quoins, with intermediate gates making two lock chambers, 400 and 200 feet long, approximately.

Guard gates would be provided at the head and foot of the lock to admit of pumping out the lock and making repairs to the gates without delay. The total length of the lock from head to tail wing walls would be 740 feet. As shown on the drawing[a] herewith, the bed rock lies at a depth of 40 feet below mean river level at the site of the proposed lock, the rock being overlaid by a bed of sand and gravel, quite hard but containing quicksand.

It would obviously be most advisable to found the lock upon bed rock, but, with the small head of water to contend with, it would not be necessary to carry the concrete or masonry walls to the rock, involving extensive excavation and the maintenance of a costly cofferdam for such construction.

As designed, the lock walls would be of concrete, founded upon timber cribs 30 feet wide, resting upon the bed rock in a trench excavated for the purpose by dredging. (Cross section on A–B.)

This cribwork would be 36 feet high for the side walls, so that when sunk in place the tops of the cribs would be 4 feet below the water level in the lock when empty. Upon the cribwork the lock walls would be built of Portland-cement concrete, 17 feet high, 20 feet wide at the base, and 8 feet wide at the top. The concrete walls would be built of concrete blocks resting upon the cribs and reaching above water line, and the remainder of the walls would be built of mass concrete. Culverts and branches for admitting water into the lock would be provided for by fitting steel pipe or vitrified culvert pipe of special construction in a specially built trough or bed on the cribs and covering them with the concrete blocks molded to fit over the pipes. The concrete walls would be heavier at the head and tail gates and at the intermediate gates to secure the extra strength required at these points. (Cross section on E–F.)

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[a] Not printed.

The side walls (cribs and concrete blocks) would be constructed complete without cofferdams; or "in the wet" so far as any construction below water level is concerned.

The end walls and gate openings would be similarly formed by sinking timber cribs on bed rock across the lock space and joining the side walls, the cribs, however, being only 13 feet high for the upper gates and 8 feet high for the intermediate and lower gates.

These crib foundations for the end walls would be built in the form of one crib for each end. The cribs would be 120 feet long and 80 feet wide, the width required for the concrete floor 8 feet thick in the gate space, in which would be embedded the cut-stone miter sills for the lock gates and the guard gates.

Upon the cribs, when sunk in place, the concrete end walls would be built with the required concrete and cut-stone construction for the lock gates, quoins, miter sills, and sluice gates for letting in water, etc.

The construction of the end walls and gate details would require the maintenance of a cofferdam at each end of the lock, so that this work could be done "in the dry." The cofferdams could be readily and advantageously built of timber in connection with and attached to the cribwork, the area inclosed thereby pumped out after the cribs are sunk in place, and the cofferdam construction removed from the cribwork after the concrete and masonry work for the lock gates, etc., was completed.

This system of crib structure surmounted by concrete wall would be banked all around the outside except in the gate spaces with backfilling of clay gravel, which would securely and permanently close all crib joints and insure a tight lock chamber against the maximum head of 30 feet of water, to be overcome when repairs would require pumping out the lock. The concrete floor, miter sills, and quoins for the intermediate lock gates would be similarly constructed on a timber-crib foundation resting on bed rock and recessed in the crib and concrete side walls of the lock previously built.

The construction of the intermediate gate fittings would also require to be done "in the dry," and the necessary cofferdam could be readily built of timber in connection with the cribwork and the construction done as planned for the main gates.

This method of lock construction would possess a great advantage in entirely avoiding the construction of a costly cofferdam inclosing the entire lock site and its maintenance at inevitably great expense for pumping out, etc., and at the same time this construction would insure permanency. It is considered advisable and the most advantageous under the conditions to be met.

In order to insure against leakage under the maximum head, when the lock chamber requires pumping out, a concrete floor would be needed in the lock chamber. This chamber would be practically excavated clean to bed rock in the process of dredging the trenches to rock for the lock-wall cribs. It would be back-filled with clay gravel or other good impervious filling material, and upon this bed a concrete floor in the form of an invert would be laid, as shown on the drawings, so as to leave a clear depth of 24 feet of water at the low level. The bed of back-filling and concrete floor would be about 15 feet thick an ample support for the cribwork in the lock walls against any tendency to slide into the chamber.

The lock construction so far described would complete all of that work except the gates and sluices and their operating machinery, which will be described further on. All of this construction work would be done in the fully protected water area between Squaw Island and the main shore. The present old ship lock and dam would remain intact as at present and all of the work would be done in water at the low level. The cribs would be constructed at the site they would occupy on grillages built ashore and floated to the site, under many advantageous conditions, and in perfect security.

*Wing walls.*—These would be required above and below the lock and would connect with the side walls of the lock on each side, as shown in the drawing. Their construction would be similar to that of the lock walls, viz, concrete superstructure on timber-crib substructure, but this substructure need not be founded directly on bed rock.

The borings show an extensive bed of fine sand overlying the bed rock. It is believed, however, that the material will prove sufficiently stable to resist settlement of the wing walls which are designed to be built of a substructure of timber cribs 24 feet wide, surmounted by a concrete superstructure 20 feet wide at the bottom and 8 feet wide at the top. Should the material overlying the rock be found to be unstable when the trench is dredged, the dredging would be carried to bed rock, 10 feet deeper, and the trench back-filled with gravel to the required grade.

For the upper wing walls the cribs would be 25 feet high, sunk in place in a trench dredged to the depth of 30 feet below the high level (mean lake level), or 7 feet deeper than the channel, 23 feet deep. On the west side of the lock the wing wall would be 170 feet long, as shown on the drawing. On the east side the wing wall proper would be 170 feet long, but a similar construction would be necessary to form the dam required to carry the high-water level from the present old lock to the proposed new lock, a distance of 550 feet; so that the total length of the wing wall must be considered as 720 feet. This wall would be provided with mooring facilities and supply a berth for vessels waiting for lockage. Wing walls of similar construction, 200 feet long each, would be placed below the lock, as shown on the drawing.

*Guide piers.*—Above the lock guide piers or bulkheads of large piles and walings would be placed along the sides of the channel way from the ends of the timber-crib concrete wing walls to the International Bridge. On the east side of the channel this guide pier would be 500 feet long, and on the west side, along the embankment on Squaw Island, 1,000 feet long.

Below the lock a similar guide pier would be placed extending downstream beyond the foot of Squaw Island to the extent admissible to the channel of Niagara River across the head of Strawberry Island. This guide pier would be 1,000 feet long. No guide pier would be placed on the east side for the reason that it would interfere with navigation to the wharves of the many industries occupying the river front from Hamilton street to Hertel avenue. The guide pier on the west side would also serve as a mooring berth for vessels waiting for lockage up.

*Culverts for filling and emptying lock.*—The general plan of constructing the lock of a timber-crib substructure surmounted by concrete walls from 4 feet below the low level to the coping and the low lift of the lock, renders it possible to provide for the filling and emptying of the lock chamber by a modification of the device usually designed for large modern locks of high lift, viz, large culverts of brick or cut stone, frequently lined with steel, built in the side walls, with branches at intervals communicating with the lock chamber.

For the proposed lock the culverts would be formed of steel pipe, such as is used for waterworks purposes, 5 feet in diameter, laid and fitted upon the side-wall cribs in a semicircular trough built in the top timbers of the cribs so as to form a secure seat for the pipe. The lower half of the pipe would thus be embedded in the cribwork, with the center of the pipe 4 feet below the low-water level. Each culvert would communicate with the lock chamber through numerous branches of about 1½ feet diameter, the combined area of cross sections of the branches being about double that of the culverts, to insure free discharge under the available hydraulic head of about 9 feet. The branches would also be formed of steel pipe, about 8 feet long, properly jointed to the culvert pipe and embedded in the top timbers of the cribwork in a manner similar to the culvert pipe. All of the pipe installation in the side walls would be done "in the wet" after the cribwork was in place, and the upper half of the pipe, projecting above the crib tops, would be covered by the concrete blocks of the concrete walls, molded to fit over the pipe. It will be noted that the discharge from the branches would be 4 feet below water level when the lock is empty, and therefore against the sides of a ship in the lock. This would not be objectionable, owing to the small head under which the waters will be discharged into the chamber.

The parts of the culverts connecting those in the side walls with the inlet and outlet ports would be located in the walls of the head-bay and tail-bay on each side and would be supplied with standard valves or gates for opening and closing the culverts. The valves would be operated by motors, hydraulic or electric. This portion of the culverts and the connections with the inlet and outlet ports and setting of valves would all be done "in the dry" in the cofferdams provided, and would be wholly embedded in the mass concrete of the lock walls to be built within the cofferdams. Culverts and branches made of vitrified culvert pipe of large diameter and special construction might be used instead of steel pipe. The vitrified pipe, while liable to crack, would not be subject to corrosion, like the steel pipe.

*Lock gates.*—The lock gates would be of steel and would conform in all respects to the standard steel gates designed by the United States Board of Engineers on Deep Waterways for a lock 60 feet wide, shown with details on plate 70 of the Board's report. The low lift of 5 feet implies only 5 feet difference in the height of upper and lower gates, and taking into consideration this small difference in height, together with the fluctuation of water level at the proposed lock, and the consequent maximum hydraulic head to be overcome by the gates, all of the gates would be of practically the same height, and the designs shown on plate 70 would answer for all of the gates, with very slight modification of height; in no way affecting construction or strength and weight of parts.

The gate shown on plate 70 is 34¾ feet high and 33¼ feet wide, designed for a depth of 31¼ feet on sill, or a maximum hydraulic head of that amount. For the proposed lock, the upper gates would be 32 feet high by 33¼ feet wide, with a maximum depth on sill of 31 feet at high water, identical with the gate shown on plate 70, except 2 feet difference in height of gate. The intermediate and lower gates would be 34 feet high by 33¼ feet wide, with a maximum depth on sills of not over 31 feet, for the reason that the increase in depth, due to fluctuations of water level, can be fully controlled by the upper gates. These intermediate and lower gates would, therefore, be in all respects identical with the gate shown on plate 70.

The gate designs on plate 70 were therefore adopted as a general and detailed design for all of the gates of the proposed lock, including all fittings and details as shown on that plate. The weights of structural steel and fittings for lock gates used in the estimate of cost were computed from the elaborate tables and curves for such computations, shown on plates 75, 77, and 79 of the Board's report.

The lock gates would all be of the two-leaf miter type, of steel, with horizontal girders, single skin, and gate hangings of ample strength to carry the entire weight of the gates, without rollers. The quoin and miter posts would have wooden bearing pieces. All gate leaves would be provided with balanced valves or wickets operated by hand power, to be used in connection with the culverts in filling and emptying locks, or in place of the culverts in case of accidents thereto.

*Operating machinery.*—It is not deemed necessary at this time to make detailed plans and estimates of the machinery required to operate the lock gates, valves, and pumps for pumping out the lock for repairs, etc. The machinery required would be quite extensive and must be of modern design. The motive power would be electrical or hydraulic. The power, probably, could be most advantageously purchased from the company furnishing Niagara Falls electrical power at Buffalo, and whose transmission lines run close to the site of the proposed lock. Hydraulic power could be generated at the head of the lock.

A lump sum of $100,000 is included in the estimate of cost to cover the item of operating machinery. It would include the necessary machinery for operating the gates, all valves in the culverts, all pumps for pumping out the lock chamber, power capstans for drawing vessels into and out of the lock chamber, all light fixtures and lights, and all buildings and housings for the machinery.

*Property and buildings.*—The proposed ship channel and lock would occupy Black Rock Harbor and the Erie Canal and the lock property appertaining thereto, and the Niagara River below that lock property. Black Rock Harbor was originally constructed by the State of New York in connection with the Erie Canal, and may be assumed to belong to the State, as well as the Erie Canal proper.

In the vicinity of the lock the State of New York owns all of the land, as shown on the map herewith, and the site of the proposed new lock is wholly within the water area of the former channel of Niagara River between Squaw Island and the mainland. It may be assumed, therefore, that the entire ship waterway and its accessories would occupy property belonging only to the United States and the State of New York.

All of New York State's right and title to the lands and waterways should be obtained by the United States, and it is believed can be so obtained, in conformity with the opinion of Hon. John Cunneen, attorney-general of the State of New York, as expressed in the following letter:

> ALBANY, *February 5, 1903.*
>
> Maj. THOMAS W. SYMONS.
>
> DEAR SIR: Your favor of January 28, explaining steps that have been taken on behalf of the General Government for the construction of a canal around the rapids of Niagara River between its head and Black Rock Harbor, and asking for information as to whether there are any objections to the United States doing the work outlined, has been received and very carefully considered
>
> The joint control of any part of the Erie Canal by the government of the State of New York and the General Government would be incompatible with the provisions of the constitution of this State, which reads: "The legislature shall not lease, sell, or otherwise dispose of the Erie Canal, the Oswego Canal, the Champlain Canal, the Cayuga and Seneca Canal, or the Black River Canal; but they shall remain the property of the State and under its management forever." (Art. 7, sec. 8.)
>
> I think, however, that that part of the Erie Canal which is within the boundaries of the proposed Black Rock Canal could be abandoned by the canal board of the State, and the land ceded to the General Government. This cession should be so drawn, however, as to amply safeguard the right of the State to receive water from the canal to be constructed by the National Government at Black Rock to supply the Erie Canal, and also to secure the right to teams drawing canal boats to pass along the bank of the proposed canal.
>
> I have talked this matter over with the members of the canal board and others here, and they all concur in the views hereinbefore expressed.
>
> Very respectfully, yours,
>
> JOHN CUNNEEN,
> *Attorney-General.*

It is probable that the State would, according to precedent, cede its lands for the purpose intended, at no cost, or only a very nominal cost. It is deemed advisable to estimate this cost at $10,000, to cover all contingencies. Assuming that the lands of the State are acquired, there would be included therein the strip of land adjacent to the present lock, together with the old mill site at the end of Bridge Street Bridge, now occupied by an old unused water-power flour mill. Much of the land area would be lost in the necessary excavation of the ship channel. This location would, however, be suitable for such storehouses and lock keepers' dwellings as would be needed, and such additional land area as might be required could be made by filling in the shoal-water area adjacent on the north of the present land area. The site of the old mill and the existing flume could be used for a power house and for generating electric power for the lock machinery and lighting if desired.

It is not deemed necessary or advisable to devise plans and estimates for the needed buildings and accessories to be provided in connection with the operation and maintenance of the ship lock. The contingencies to be provided for may be estimated in a lump sum, and would not in all probability exceed in cost $50,000.

## REMARKS.

As previously stated the east channel of the Niagara River, from the foot of Hertel avenue to the head of the natural deep harbor along Grand Island, would require deepening in order to fully accomplish the object sought by the construction of the ship channel and its lock; but it should be fully understood that the use of the proposed Black Rock Harbor-Erie Canal waterway and ship lock would not depend upon the complete excavation of the Niagara River channel below the lock. The large class of vessels now carrying lumber and iron ore to Tonawanda would quickly avail themselves of the new waterway, which would admit of their increasing their loaded draft at least 2½ feet or to 17½ feet at mean level; and many other vessels, of not more than 18 feet loaded draft, which dare not venture through the rapids and shoals of the river, could navigate the existing river channel below the ship lock. The excavation herein considered would only be required to make the waterway fully available for the deepest draft and largest lake vessels, which would be used in the prospective commerce which the deep waterway would encourage and develop, to the great natural harbor along Grand Island. This channel improvement should, if ever undertaken, aim to secure a channel 400 feet wide and 23 feet deep at mean river level, so that it would be commensurate with the ship channel and lock.

From the foot of Hertel avenue to the head of Strawberry Island reef (a distance of about 5,000 feet) the required excavation would be in sand, clay, and gravel. The Strawberry Island reef is formed by a ledge of limestone rock extending across the river. The length of the channel through the reef is 2,400 feet; it has been excavated 400 feet wide and 18 feet deep at mean river level. The required excavation to secure the new channel 400 feet wide and 23 feet deep would be in limestone rock, requiring drilling and blasting and dredging for a depth of 5 feet over the length of channel of 2,400 feet and width of 400 feet.

Below Strawberry Island reef there would be required the excavation, to a greater or less extent, of 8,000 linear feet of channel to the head of the natural deep-water harbor. This excavation would be all in gravel and clay.

The cost of this channel excavation can not be closely estimated, as exact data are lacking. It may be approximately estimated, however, at $500,000, of which sum $360,000 would be needed for rock excavation across Strawberry Island reef.

## ESTIMATE OF COST.

The following is the estimate of cost for the proposed Black Rock Harbor-Erie Canal channel for deep-draft vessels, as described and considered under "I," and for the proposed ship lock, wing walls, guide piers, property and buildings, and all accessories, as described in "II":

### I.

*The ship channel.*

| | |
|---|---|
| Reconstruction of trunk sewer | $100,000 |
| Ferry Street Bridge, clear waterway of 150 feet (if built with clear waterway of 200 feet add $35,000) | 70,000 |
| Repairs to towpath wall and channel bank | 75,000 |
| Bird Island pier, concrete superstructure | 18,600 |
| Bird Island pier, new pier | 15,000 |
| Bird Island pier, general repair | 75,000 |
| Squaw Island embankment | 3,000 |
| Removal of canal wall, 9,000 linear feet, at $8 per linear foot | 72,000 |
| Removal of old ship lock | 5,000 |
| Channel excavation: | |
| Earth, 1,360,000 cubic yards, place measure, at 18 cents per cubic yard | 244,800 |
| Rock, 609,000 cubic yards, place measure, at $2.25 per cubic yard | 1,370,250 |
| | 2,048,650 |
| Contingencies and engineering, 10 per cent | 204,865 |
| | 2,253,515 |

## II.

*The ship lock, wing walls, etc.*

| | |
|---|---|
| Excavation for lock and wing walls, 250,000 cubic yards, place measure, at 25 cents per cubic yard | $62,500 |
| Timber cribwork, in lock walls, sunk in place and filled with stone: | |
| 1,148 linear feet, 36 by 30 feet, at $125 per linear foot | 143,500 |
| 120 linear feet, 86 by 13 feet, at $150 per linear foot | 18,000 |
| 120 linear feet, 80 by 8 feet, at $90 per linear foot | 10,800 |
| 70 linear feet, 40 by 8 feet, at $45 per linear foot | 3,150 |
| Cofferdams for lock spaces, 1,000 linear feet, including removal | 50,000 |
| Steel culverts, 1,300 linear feet, 60 inches diameter, 6 valves, 40 branches, 18 inches diameter, 400 linear feet | 40,000 |
| Portland-cement concrete in lock walls and floor, 33,500 cubic yards, at $8 per cubic yard | 268,000 |
| Back-filling and embankment outside of lock and wing walls, 125,000 cubic yards, at 30 cents per cubic yard | 37,500 |
| Back-filling in lock chamber, 12,000 cubic yards, at 50 cents per cubic yard | 6,000 |
| Granite miter sills and hollow quoins, 550 cubic yards, at $45 | 24,750 |
| Structural steel in gates, 1,260,000 pounds, at 5 cents | 63,000 |
| Steel castings, 79,000 pounds, at 6 cents per pound | 4,740 |
| Steel forgings, 37,000 pounds, at 10 cents per pound | 3,700 |
| Bronze bushings, 3,500 pounds, at 40 cents per pound | 1,400 |
| Anchor and other bolts, 50,000 pounds, at 5 cents per pound | 2,500 |
| Oak timber, 50,000 feet B. M., at $50 per M | 2,500 |
| Operating machinery and all accessories | 100,000 |
| Timber crib work in wing walls, sunk in place and filled with stone, 1,290 linear feet, 25 by 24 feet, at $70 per linear foot | 90,300 |
| Portland-cement concrete superstructure, on wing walls, 1,290 linear feet, at $50 per linear foot | 64,500 |
| Oak pile and waling guide piers, 2,500 linear feet, at $20 per linear foot | 50,000 |
| Mooring devices on wing walls and guide piers | 2,000 |
| Acquiring State property | 10,000 |
| Made lands and buildings | 50,000 |
| | 1,108,840 |
| Contingencies and engineering, 10 per cent | 110,884 |
| Total | 1,219,724 |

*Summary.*

| | |
|---|---|
| The ship channel | 2,253,515 |
| The ship lock, etc | 1,219,724 |
| Total cost, including 10 per cent for contingencies and engineering | 3,473,239 |

I desire to acknowledge, with appreciation, the valuable service done by Mr. J. C. Quintus, C. E., assistant engineer, of this office, in working up the details of this report.

Very respectfully, your obedient servant,

Theo. A. Bingham,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First Indorsement.]

U. S. Engineer Office, Eastern Division,
*New York City, October 6, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

The report appears to fully cover the subject, and the plans are for an adequate improvement. The estimates are, in my opinion, ample for the probable cost. Before undertaking any work under this project it would be advisable to have all safeguards possible with regard to the relinquishment to the United States of any and all State rights necessary for the prosecution and maintenance of the work, and also careful provisions made regarding any interference with municipal and private rights.

AMOS STICKNEY,
*Colonel, Corps of Engineers,*
*Division Engineer.*

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## Q Q 8.

## PRELIMINARY EXAMINATION AND SURVEY OF ERIE BASIN, BUFFALO HARBOR, NEW YORK.

[Printed in House Doc. No. 35, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith, for transmission to Congress, copies of reports dated October 4, 1902, and March 16, 1903, by Maj. T. W. Symons, Corps of Engineers, upon preliminary examination and survey of Erie Basin, Buffalo Harbor, New York, made in compliance with requirements of the river and harbor act of June 13, 1902, reference being made to indorsements on these reports by the division engineers, Col. S. M. Mansfield (now brigadier-general, U. S. Army, retired) and Col. Amos Stickney, Corps of Engineers.

Erie Basin is a portion of the general harbor of Buffalo, N. Y., and is formed by a stone breakwater built by the State of New York in 1862 for the protection of canal boats. The basin and breakwater are situated on what were once private lands above water, which were purchased by the city and conveyed to the State.

It appears from the local officer's report on preliminary examination that, in view of the ownership of the basin and the action of the State with reference to its improvement, it is questionable whether the General Government has authority to make or would be justified in making needed improvements. He expresses the opinion that the present and prospective demands of commerce justify, and unqualifiedly recommends, removal of a portion of the south end of the breakwater on the west of the harbor. He presents in his report on survey two plans for improvement between harbor lines by excavating to a depth of 23 feet below mean lake level, as indicated by the zero of the United States engineer gauge at south pier, except that where bed rock is found at a depth of 22 feet the excavation will be limited to that depth. The estimated cost is:

| | |
|---|---|
| For excavation of entire basin | $475,426.82 |
| For channel 200 feet wide | 257,684.46 |

Both estimates include removal of 125 feet of the New York State breakwater at an estimated cost of $23,661.

In forwarding the report on survey the division engineer, Colonel Stickney, states that he is unable to concur in the opinion of the district officer as to the worthiness of the work unless it should be decided by competent authority that the United States has jurisdiction over the waters of the basin, and that the main object of the work appears to be to provide a channel for the largest vessels to get to and from a limited portion of the city front. The demands of commerce justifying the work should, in his opinion, be more clearly shown.

Pursuant to the provisions of sections 3 and 14 of the act of June 13, 1902, these reports have received consideration by the Board of Engineers for Rivers and Harbors, and attention is invited to its report in indorsement of April 21, 1903, from which the following is an extract:

> The Board is of opinion that it is not desirable for the United States to enter upon any improvement of Erie Basin, as contemplated in the act directing the preliminary examination, until the channel between the breakwater and the main shore shall have become a navigable waterway of the United States, and until title to so much of the old breakwater as must be removed shall be vested in the United States. To secure these conditions will require legislative action by the State of New York. When legal obstacles to the work have been removed, commercial needs as they may then manifest themselves should be weighed against the cost of the work as shown by the survey, in order to determine the advisability of the improvement.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF ERIE BASIN, BUFFALO HARBOR, NEW YORK.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., October 4, 1902.*

GENERAL: I have the honor to submit the following preliminary report on "Erie Basin, New York," called for by your letter of June 23, 1902:

Erie Basin is a portion of the general harbor of Buffalo, N. Y. It lies to the north of the Buffalo Creek entrance, and is formed by a stone breakwater about 2,300 feet long, situated at a distance from the main shore varying from 300 to 1,000 feet. This was built by the State of New York in 1862, and gave a protected harbor, intended especially for canal boats, before the main Government breakwater was built.

This Erie Basin and breakwater are situated on what were once lands above water in private ownership. A shelter was needed for canal boats, and in accordance with an understanding the city of Buffalo purchased the land, and the State of New York appropriated the money and constructed the breakwater and basin.

The land was conveyed to the State by the city in 1847 and 1849, and the basin was finally completed in 1862. The building since then of the Government breakwater has rendered the Erie Basin breakwater of far less value than formerly, and the increase of business on the lake in large vessels has materially changed the use to which the Erie Basin can best be put. Instead of a simple shelter and harbor for canal boats, it is now used to the greatest extent possible by large vessels for grain, coal, lumber, and package freight business. In

1899 the State of New York appropriated $35,000 for deepening this basin, and in 1902 it made another appropriation of $50,000 for the same purpose. The money was and is to be expended in making a narrow channel suitable for large vessels along the shore side of the basin.

The increase in the width of this narrow channel to be constructed by the State will be needed, and the expenditure of the necessary funds for the purpose is justifiable.

In view of the ownership of the basin, its method of acquirement, its having been constructed and maintained by the State, its originally comtemplated use, and the fact that the State has entered upon the work of deepening it by appropriating money therefor, it is perhaps a legal question whether the Government has authority to make or would be justified in making the needed improvements.

There is no doubt, however, that the present and prospective demands of commerce justify the deepening of this basin, and I therefore recommend the improvement, if it be deemed a proper work for the Government to undertake.

There is one piece of work connected with the basin that I would unqualifiedly recommend, and that is the removal of 212 feet from the south end of the breakwater bounding it on the west. The removal of this 212 feet is needed for the benefit of vessels entering both Buffalo River and the Erie Basin, and has before this been recommended. It has long been recognized that the southerly end of this Erie Basin breakwater is an obstruction to navigation, and before 1868 it was proposed to cut off 212 feet, provided the consent of the State of New York could be obtained. The State in 1868 passed an act authorizing the United States to remove 212 feet of the breakwater, but it has never been done. Under the new conditions its removal has become more imperatively necessary than ever. The breakwater and the United States south pier together form a sheltered eddy area in which sediment brought by the prevailing currents is deposited, forming shoals which encroach more and more on the entrance channel.

To remove this portion of the Erie Basin breakwater and the shoal on which it is situated will cost, it has been estimated, $30,000.

To make a complete survey of the Erie Basin to determine the amount of the necessary deepening will cost, it is estimated, $300. To determine the cost of removing the 212 feet of the breakwater no expenditure will be required.

### COMMERCIAL STATISTICS.

The following is a list of the established industries on the Erie Basin:

1. Philadelphia and Reading Coal Company, trestle.
2. Montgomery Lumber Company, yard.
3. Erie Basin elevator, now occupied by J. H. Ross as storehouse for builders' supplies, principally cement.
4. Bateman, McDougall & Palmer, shipyard.
5. Empire Shipbuilding Company, shipyard.
6. Lake Erie Dredging Company, yard.
7. Buffalo Fire Department, steamer *Hutchinson*.
8. O'Neill's Floating Dry Dock (on west side of basin).
9. H. M. Poole & Co., lumber yard.
10. D. Y. Leslie, lumber yard (Citizens' Ice Company, directly in rear).
11. Exchange elevator (capacity 250,000 bushels). (Grand Trunk Railroad freight shed directly in rear, on slip.)
12. New York Central and Hudson River Railroad, freight shed.
13. Delaware, Lackawanna and Western iron ore and coal dock. (With Haines Lumber Company directly in rear, on Coit slip.)

It is impracticable to separate the tonnage and other details of commercial statistics from those of the city of Buffalo, of which the Erie Basin forms a part.

Very respectfully, your obedient servant,

T. W. SYMONS,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 9, 1902.*

Respectfully referred to Col. S. M. Mansfield, Corps of Engineers, division engineer, eastern division, for remark and recommendation. To be returned.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,*
*U. S. Army.*

[Second indorsement.]

U. S. ENGINEER OFFICE, EASTERN DIVISION,
*New York City, October 14, 1902.*

Respectfully returned to the Chief of Engineers, United States Army, concurring in the views of the district officer that the demands of commerce justify the deepening of this basin, and recommend that a survey be made for the purpose of determining the cost of the needed improvement.

By the establishment of harbor lines on both sides of the basin it is clear that the United States has assumed jurisdiction over the body of water lying between, and it therefore became a navigable waterway, the improvement of which is deemed a proper work to be undertaken by the Government.

The improvement of the basin under State appropriations is presumably in accordance with the sixth paragraph next preceding the last in section 1 of the river and harbor act of June 13, 1902.

S. M. MANSFIELD,
*Colonel, Corps of Engineers.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*October 20, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Fourth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 4, 1902.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of Major Symons on the preliminary examination of Erie Basin, New York.

In the opinion of the Board the commerce involved is so large and of such a general character as to warrant an improvement of the locality by the General Government to the extent contemplated by the district officer, provided such improvement can be made at reasonable cost.

The Board, therefore, recommends that there be made an allotment of $300, as requested by the district officer, with which to make a survey and estimate of cost.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*December 6, 1902.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Erie Basin, Buffalo, N. Y., authorized by the river and harbor act of June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,*
*U. S. Army.*

[Sixth indorsement.]

WAR DEPARTMENT,
*December 8, 1902.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
*Acting Secretary of War.*

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 1, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Eighth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 21, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

It appears from the reports upon the examination and the survey that Erie Basin is not a natural navigable waterway, but was excavated by the State of New York in lands originally above water. Were it proper under the law for the United States to deepen or otherwise improve the basin without acquiring ownership, the State would undoubtedly still retain at least a partial control over the improved basin; and might, under its own laws, limit its free use as a national waterway.

The authority granted by the State of New York to remove a portion of the southerly end of the State breakwater is so limited by conditions as to ownership of the portion removed that the cost of the work might be largely increased by the necessity of preserving the material for use by the State.

The Board is of opinion that it is not desirable for the United States to enter upon any improvement of Erie Basin, as contemplated in the act directing the preliminary examination, until the channel between the breakwater and the main shore shall have become a navigable waterway of the United States, and until title to so much of the old breakwater as must be removed shall be vested in the United States. To secure these conditions will require legislative action by the State of New York. When legal obstacles to the work have been removed, commercial needs as they may then manifest themselves should be weighed against the cost of the work as shown by the survey, in order to determine the advisability of the improvement.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

## SURVEY OF ERIE BASIN, BUFFALO HARBOR, NEW YORK.

United States Engineer Office,
*Buffalo, N. Y., March 16, 1903.*

General: I have the honor to report on a survey, with plan and estimate of cost, for the improvement of Erie Basin, Buffalo, N. Y., to comply with the provisions of the river and harbor act of June 13, 1902, and your letter of December 11, 1902.

Erie Basin is a portion of the general harbor of Buffalo, N. Y. There is submitted herewith a tracing[a] showing the Erie Basin and parts of Buffalo Harbor adjacent thereto, and the improvements proposed.

These improvements have for their aim the increase in depth and capacity of the Erie Basin, so that it may be utilized to its full extent by the large lake vessels of the present day. At the present time the depth and capacity of the channel way in the basin, taking into consideration the restricted deep channel now being excavated by the State of New York as shown on the tracing, limits the use of the basin to vessels of small size; for while the depth of the narrow channel is sufficient for large vessels, the width thereof is so restricted that large vessels 400 to 500 feet long can not be handled in it, except at the southerly end, where the large vessels can, with the aid of a tug and

---

[a] Not printed.

*Basin from west limit of 200-foot channel to west harbor line.*

| | | |
|---|---|---|
| Dredging 123,398 cubic yards, place measure, of sand, clay, etc., at 20 cents per cubic yard | $24,679.60 | |
| Excavating 57,756 cubic yards, place measure, of bed rock, at $3 per cubic yard | 173,268.00 | |
| Total for basin west of 200-foot channel | | 197,947.60 |
| Total for entire basin | | 410,696.20 |
| Contingencies, engineering, etc., 10 per cent | | 41,069.62 |
| Grand total | | 451,765.82 |

*Removal of 125 linear feet of the south end of the New York State breakwater and excavation of channel between Buffalo entrance channel and Erie Basin, as shown on the drawing herewith, to depth of 23 feet below mean lake level.*

| | |
|---|---|
| Removing stone wall and riprap to mean lake level, 1,272 cubic yards, place measure, at $3 per cubic yard | $3,816.00 |
| Removing riprap stone from mean lake level to level of bottom of cribs, 2,408 cubic yards, place measure, at $3 per cubic yard | 7,224.00 |
| Drawing piles, 280, at $1.50 | 420.00 |
| Removing cribs, 125 linear feet of crib, 12 by 20 feet, at $10 per linear foot | 1,250.00 |
| Excavating channel: | |
| Dredging 14,000 cubic yards, place measure, of sand, clay, etc., at 20 cents per cubic yard | 2,800.00 |
| Removing large stone embedded in the sand, clay, etc | 1,000.00 |
| Excavating 1,000 cubic yards, place measure, of bed rock, at $3 per cubic yard | 3,000.00 |
| Rebuilding riprap and end of wall | 2,000.00 |
| | 21,510.00 |
| Contingencies, engineering, etc., 10 per cent | 2,151.00 |
| Total | 23,661.00 |

*Summary for entire work.*

| | |
|---|---|
| Excavation of Erie Basin | $451,765.82 |
| Removal of south end of New York State breakwater | 23,661.00 |
| Total | 475,426.82 |

*Summary for channel 200 feet wide.*

| | |
|---|---|
| Excavation of channel 200 feet wide | $234,023.46 |
| Removal of south end of New York State breakwater | 23,661.00 |
| Total | 257,684.46 |

## INFORMATION AND REMARKS.

Your letter of December 11, 1902, further states that this report shall contain "a further expression of your opinion as to whether this is a proper work to be undertaken by the General Government," and "any additional facts or arguments that may be deemed essential to permit of a full and complete consideration of the merits of this case both by this Department and by Congress."

As stated in my report on the preliminary examination of Erie Basin, October 4, 1902—

> There is no doubt, however, that the present and prospective demands of commerce justify the deepening of this basin, and I therefore recommend the improvement, if it be deemed a proper work for the Government to undertake.

The question of the propriety of the General Government's doing the work arises from the ownership of Erie Basin by the State of New York, and the State's having entered upon its improvement in recognition of the demands of lake commerce in its intimate relations with that of the Erie Canal. The history of this ownership and improvement is given briefly in my report of October 4, 1902, on the preliminary examination of Erie Basin, and need not be further extended.

I am of the opinion that the assumption by the General Government of the further improvement of Erie Basin is justifiable, for the reason that it is doubtful if the State of New York will improve the Erie Basin to an extent beyond that provided for in existing laws, copies of which are appended to this report, marked "Appendix A" and "Appendix B," and further, it appears quite certain that even the channel 150 feet wide provided for in these laws will not be completed by the State, in view of the great demands upon the State for radical and costly improvement of the Erie Canal proper.

As shown upon the tracing herewith, the channel actually constructed and now being completed by the State authorities is practically only 60 feet wide, this width being all that could be secured under the appropriations made by the laws of 1898 and 1902, viz, $80,000, owing to the costliness of the rock excavation, now enhanced above normal conditions by the prevailing high prices of materials and labor.

The portion of the channel now being excavated under the law and appropriation of 1902, under a contract with the Buffalo Dredging Company, of Buffalo, N. Y., to be completed in 1903, will cost, exclusive of superintendence and engineering, $41,424.60, the conditions of the contract being to remove 7,140 cubic yards, place measure, of sand, clay, etc., at 25 cents per cubic yard, and 10,890 cubic yards, place measure, of bed rock, at $3.64 per cubic yard. As shown on the tracing, this work will complete a channel 60 feet wide, flaring to 150 feet wide at the south end of the basin, 23 feet deep at mean lake level.

A strong campaign is being waged to induce the State to expend $101,000,000 for the improvement of the Erie, Oswego, and Champlain canals. A bill to this effect has been favorably reported in the senate and assembly, and will probably pass the legislature and be submitted to a vote of the people in the fall of 1903. If this is carried out it will greatly increase the necessity for the improvement of the Erie Basin, giving a thoroughly sheltered and suitable place where big ships and the canal barges can come together for the transaction of business.

Very respectfully, your obedient servant,

T. W. SYMONS,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, EASTERN DIVISION,
*New York City, March 28, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

In report of October 4, 1902, upon the preliminary examination of Erie Basin, Major Symons relates that "This Erie Basin and breakwater are situated on what were once lands above water in private ownership. * * * The city of Buffalo purchased the land and the State of New York appropriated the money and constructed the breakwater and basin. The land was conveyed to the State by the city in 1847 and 1849, and the basin was finally completed in 1862;" and further on in his report he states, "in view of the ownership of the basin, its method of acquirement, its having been constructed and maintained by the State, its originally contemplated use, and the fact that the State has entered upon the work of deepening it by appropriating money therefor, it is perhaps a legal question whether the Government has authority to make, or would be justified in making, the needed improvements. There is no doubt, however, that the present and prospective demands of commerce justify the deepening of this basin, and I therefore recommend the improvement if it be deemed a proper work for the Government to undertake."

In Department letter of December 11, 1902, assigning charge of the survey of the basin to Major Symons, the following instruction was given: "It is desired that your further report * * * contain a further expression of your opinion as to whether this is a proper work to be undertaken by the General Government." In compliance with this last instruction, Major Symons, in this report on the survey of the basin, states * * *: "I am of the opinion that the assumption by the General Government of the further improvement of Erie Basin is justifiable, for the reason that it is doubtful if the State of New York will improve the Erie Basin to an extent beyond that provided for in existing laws, * * * and further, it appears quite certain that even the channel 150 feet wide provided for in these laws will not be completed by the State in view of the great demands upon the State for radical and costly improvement of the Erie Canal proper."

I am unable to concur in the above opinion of the district officer, unless it should be decided by competent authority that the United States has jurisdiction over the waters of the basin. The manner in which the basin came into existence, and the undoubted exercise of jurisdiction over it by the State of New York for many years, a jurisdiction which, so far as known, has not been questioned, appear to me to establish a complete bar to the expending of money from the National Treasury upon the basin, or to permitting the General Government to in any way alter it. The establishment of United States harbor lines along the basin does not, in my opinion, alter the case, for I question whether the State of New York, or any individual acting under authority of the State of New York, could be compelled to pay any attention to those lines.

After the question of jurisdiction, there arises the question of propriety of the General Government expending a large sum in deepening the basin. A large harbor, protected by extensive breakwaters, has already been provided, and a channel for entrance to Black Rock Harbor is under contract. The main object of the work would then appear to be to provide a channel for the largest vessels to get to and from a limited portion of the city front.

The demands of commerce justifying the work should, I think, be more clearly shown.

AMOS STICKNEY,
*Colonel, Corps of Engineers,*
*Division Engineer.*

## APPENDIX A.

### LAWS OF NEW YORK, EXTRACT FROM CHAPTER 635, 1898.

AN ACT To facilitate state commerce by increasing the depth of water in the Erie Basin at Buffalo, and making an appropriation therefor.

* * * * * * *

SECTION 1. The superintendent of public works is hereby authorized and directed, on or before the opening of navigation in the Erie Canal in the year 1898, or as soon thereafter as practicable, to deepen and improve that portion of the Erie Basin at Buffalo lying between the southerly line of slip number two, extended westerly, and the northerly line of slip number three, by enlarging, extending, and improving the channel, already partially constructed, to a width not exceeding one hundred and fifty feet, and to a uniform depth of not less than twenty feet, which improvement shall be commenced at the southerly line of slip number two, extended westerly, and progress along the channel already partially constructed northerly to the northerly line of slip number 3.

* * * * * * *

SEC. 4. The sum of thirty thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any moneys in the treasury not otherwise appropriated, for the purposes defined by this act, to be paid by the treasurer on the warrant of the comptroller, to the order of the superintendent of public works, in such sums as he may from time to time require in the prosecution of the aforesaid work.

SEC. 5. This act shall take effect immediately.

* * * * * * *

## APPENDIX B.

### LAWS OF NEW YORK, EXTRACT FROM CHAPTER 595, 1902.

AN ACT Making an appropriation for certain expenses of government, and supplying deficiencies in former appropriations.

* * * * * * *

For the superintendent of public works the sum of fifty thousand dollars, or so much thereof as may be necessary, for deepening and improving that portion of Erie basin at Buffalo, lying between the northerly line of the deep channel of the Buffalo River and the southerly end of the improvement done pursuant to chapter 635 of the laws of 1898, said point being in the vicinity of slip number two, by enlarging, extending, and improving the channel already partially constructed, to a width not exceeding one hundred and fifty feet, and to a uniform depth of not less than twenty-two feet below mean lake surface, as established by the U. S. Government, which improvement shall be commenced at the northerly line of the deep channel of the Buffalo River and progress along the channel already partially constructed northeasterly within lines to be established by the State engineer and surveyor. The performance of all work provided by this act shall be by contract secured by proper bond entered into and duly executed by and between the superintendent of public works and the contractor or contractors performing the same, except such portion thereof as in the judgment of the superintendent of public works and the State engineer and surveyor can not be so done to the best interests of the State. * * *

## APPENDIX C.

### LAWS OF NEW YORK, EXTRACT FROM CHAPTER 374, 1868.

AN ACT Giving permission to the United States to remove a portion of the public work known as the "Erie Basin Breakwater" in or near Buffalo Harbor.

* * * * * * *

SECTION 1. Permission is hereby given to the United States of America to remove so much of the southerly end, to the extent of two hundred and twelve feet, of the public State work known as the "Erie Basin Breakwater," situated in or near the said harbor of Buffalo, as the United States may direct the officer in charge of the said

The tracing has been prepared for the signature of the Secretary of War, and it is recommended that he place his approval thereon.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Secretary of War under date of August 17, 1903, the approval being indicated on the map.

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### DESCRIPTION OF MODIFIED HARBOR LINE, BUFFALO HARBOR, NEW YORK.

Beginning at a point in a line at right angles to the established axis of the old breakwater, and passing through the north corner of the outer end of the United States south pier, which point is 1,618 feet distant from said axis; thence southeasterly in a straight line parallel with said axis 6,525 feet, more or less, to the point of intersection of said parallel straight line with a line at right angles to said axis at the extreme southerly end of the old breakwater; thence southeasterly in a straight line, deflecting lakeward 2,275 feet, more or less, to the point of intersection of said straight line with a line at right angles to the established axis of the south harbor section of the breakwater which intersects the center line of the United States sand catch pier at the outer end thereof, and which point of intersection is 1,630 feet from the established axis of the south harbor section of the breakwater; thence southeasterly in a straight line parallel with the established axis of the south harbor section of the breakwater, 8,100 feet, more or less, to the point of intersection of said parallel straight line with a line at right angles to the axis of the Stony Point section of breakwater at the extreme northwesterly or outer end thereof; thence southeasterly in a straight line, deflecting lakeward 1,651 feet, more or less, to the point of intersection of said straight line with a straight line making an angle of 86° with the established axis of said Stony Point section of breakwater, measured toward the east from, when sighting northerly on, this established axis at a point in said axis 1,200 feet northerly from the inner or shore end of said axis as heretofore defined, the said point of intersection being distant from the said axis, and on the said line making an angle of 86° thereto, 1,313.5 feet; thence westerly on the last described line 1,289.5 feet to the harbor face of said Stony Point section of breakwater.

The harbor lines as described to be established as a coincident bulkhead and pierhead line; it being understood that no filling shall be allowed beyond the line marked "Present shore line at mean lake level," except it be confined within suitable permanent bulkheads.

# APPENDIX R R.

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## IMPROVEMENT OF HARBORS ON LAKE ONTARIO AND OF ST. LAWRENCE RIVER AND HARBORS THEREON, NEW YORK.

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*REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. THEO. A. BINGHAM AND FIRST LIEUT. P. S. BOND, CORPS OF ENGINEERS.*

### IMPROVEMENTS.

1. Wilson and Oak Orchard harbors, New York.
2. Olcott Harbor, New York.
3. Harbor at Charlotte, New York.
4. Harbor at Great Sodus Bay, New York.
5. Harbor at Little Sodus Bay, New York.
6. Harbor at Oswego, New York.
7. Harbor at Cape Vincent, New York.
8. Shoals in the St. Lawrence River between Ogdensburg, New York, and the foot of Lake Ontario.
9. Harbor at Ogdensburg, New York.

### EXAMINATIONS AND SURVEY.

10. Olcott Harbor, New York.
11. Oswego Harbor, New York.

### HARBOR LINES.

12. Olcott Harbor, New York.

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(For letter of transmittal see Appendix Q Q.)

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## R R 1.

## IMPROVEMENT OF HARBORS AT WILSON AND OAK ORCHARD, NEW YORK.

### (A) WILSON HARBOR.

### REPORT OF OPERATIONS.

Necessary repairs were made to the decking and wall timbers of superstructure of both east and west piers.

The principal work was placing a bulkhead of 10 by 12 inch timber in the outer end of the west pier, the crib wall having been carried away from mean lake level to about 5 feet below. The bulkhead was fastened by divers. Eighty-four cubic yards of filling stone and 11,360 feet B. M. of hemlock timber and plank were used in the above work, which cost for labor and material $938.98. The repair work was begun September 1 and completed November 9, 1903.

### PROPOSED OPERATIONS AND REMARKS.

In a letter dated December 2, 1903, transmitting to the Secretary of War the report of the Board of Engineers for Rivers and Harbors, on Wilson Harbor, printed in House Document No. 166, Fifty-eighth Congress, second session, and herewith, the Chief of Engineers states:

> * * * In view of the facts recited in its report and in the second indorsement thereon, the Board recommends that no further work be done at Wilson Harbor. I concur in this recommendation.
>
> I recommend that this letter and the accompanying report be transmitted to the Speaker of the House of Representatives for the information of Congress. * * *

The piers are in need of extensive repairs to place them in thorough condition, and the channel between the piers is not stable, filling with sand driven by storms. The channel is now, however, 9½ feet deep at mean lake level, or 7 feet deep at low water, and of a width to admit the few vessels trading at the port—about 50 feet. A moderate amount of dredging will maintain a channel sufficient for the present needs, and the piers can also be maintained intact for a few years longer at moderate cost.

Assuming that the harbor is to be maintained by the Government, there will be required for the next fiscal year, to keep the present channel open and to keep the piers intact, but not secure against violent storms, the sum of $3,000, in addition to the balance available.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,824.61 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 1,331.04 |
| July 1, 1904, balance unexpended | 493.57 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 3,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 3, 1875 | $10,000.00 | June 3, 1896 | $5,000.00 |
| August 14, 1876 | 10,000.00 | May 12, 1897 | .50 |
| June 14, 1880 | 10,000.00 | March 3, 1899 | 2,500.00 |
| March 3, 1881 | 10,000.00 | June 13, 1902 (allotment July 16, 1902) | 2,250.00 |
| August 2, 1882 | 10,000.00 | | |
| August 5, 1886 | 10,000.00 | | |
| August 11, 1888 | 5,000.00 | Total | 74,750.50 |

### COMMERCIAL STATISTICS FOR WILSON, N. Y.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from foreign ports. |  | Departures to foreign ports. |  |
|---|---|---|---|---|
|  | No. | Tons. | No. | Tons. |
| Steam | 1 | 20 | 1 | 20 |
| Sail and barges | 5 | 262 | 5 | 262 |
| Total | 6 | 282 | 6 | 282 |

| | |
|---|---|
| Total arrivals and departures (tonnage, 564) | 12 |
| Greatest draft of vessels ....feet.. | 8½ |
| Amount of revenue collected year ending December 31, 1903 | $389.60 |
| Value of foreign imports year ending December 31, 1903 | $3,046.20 |
| Value of foreign exports year ending December 31, 1903 | None. |

*Receipts by lake.*

[Net tons.]

| Articles. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|---|
| Lumber and logs | 234 | 81 | 612 | 265 | 131 | 479 |
| Fruit and merchandise | 60 |  |  |  |  |  |
| Lath |  | 12 | 17 | 39 | 17 | 10 |
| Shingles |  | 31 | 24 | 8 |  |  |
| Total | 294 | 124 | 653 | 312 | 148 | 489 |

No shipments by water. Several thousand passengers arrive and depart by water annually.

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## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS RELATIVE TO THE ADVISABILITY OF CONTINUING THE WORK OF IMPROVEMENT AT WILSON HARBOR, NEW YORK, OR OF MODIFYING THE PROJECT THEREFOR.

[Printed in House Doc. No. 166, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 2, 1903.*

Sir: By letter dated April 25, 1903, there was transmitted to this office by the chairman of the Committee on Rivers and Harbors of the House of Representatives a resolution of the committee, from which the following is an extract:

*Resolved by the Committee on Rivers and Harbors*, That the Board of five engineer officers, established by section 3 of the river and harbor act of June 13, 1902, be requested to make reports to Congress not later than the first Monday in Deceml 1903, upon the following projects, with a view to making recommendations upon desirability of continuing the same, or any modification thereof, or to report specifically stated with the designation of the respective projects: * * * Hart at Wilson * * * New York—

and I have the honor to submit herewith a report on the subject, dat July 20, 1903, by the Board of Engineers for Rivers and Harbors.

This locality has been improved by the General Government, unc a project for obtaining a 12-foot channel between parallel piers fr deep water in Twelve-mile Creek to the 12-foot curve in Lake Ontar modified in 1900 to provide for maintenance of a depth of 10 feet mean low water, the sum of $72,500.50 having been expended up June 30, 1902, in pier construction and dredging. The Board h carefully considered all the data available on the subject, has visit the locality through a committee, and has held a public hearing which all interested parties were given an opportunity to express th views. In view of the facts recited in its report and in the seco indorsement thereon, the Board recommends that no further work done at Wilson Harbor. I concur in this recommendation.

I recommend that this letter and the accompanying report be trar mitted to the Speaker of the House of Representatives for the infc mation of Congress, as requested in the resolution referred to.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 20, 1903.*

GENERAL: By first indorsement, Office Chief of Engineers, Unit States Army, May 1, 1903, there was referred to the Board of Eng neers for Rivers and Harbors a resolution adopted by the Committ on Rivers and Harbors of the House of Representatives, wherein the was required among other things the opinion of the Board upon t advisability of continuing the work of improvement at Wilson Harbo New York, or modifying the project therefor.

The Board has studied all data at hand, including memoranda recent prepared by the district officer, has made an inspection of the wo through a committee, and has conducted a public hearing at whi parties interested in the improvement had full opportunity for expre sion of their views.

The accompanying table shows the more important harbor faciliti upon the south shore of Lake Ontario.

The commerce of Lake Ontario is limited in comparison with th of the lakes above Niagara Falls, and is in general confined to vess which can pass the Welland Canal and the new St. Lawrence canal All the harbors on the lake are planned to accommodate vessels th limited in size; the latter is determined by the dimensions of the locks, which are: Length, 270 feet; width, 45 feet, and depth, 14 feet at mean lake level. The United States commerce on the lake is generally confined to coal shipped from Charlotte, Great and Little Sodus bays, and Oswego to Canadian ports on the lake and the United States and Canadian ports on the St. Lawrence River; to grain and other products shipped from upper lake ports through the Welland Canal to St. Lawrence River points; to lumber from Canadian ports, and to pleasure traffic through the lake and on the St. Lawrence River. (Survey of Northern and Northwestern Lakes, Bulletin No. 12 E, 1902.)

A harbor of refuge has recently been begun by the United States at Cape Vincent to accommodate vessels and tows which, coming up the St. Lawrence River and approaching the lake, find storm conditions such as to make it unsafe for them to venture into the open lake.

Though a harbor has been in existence at Wilson for many years, no railway has made that harbor its lake terminus. Before the country about Wilson was provided with cheap land transportation routes, the harbor was much used for local shipments to and from the neighboring rich agricultural district, but changed conditions have reduced this commerce to almost nothing (312 tons in 1901).

There is no probability of a change in conditions that will create a considerable general commerce at Wilson; certainly no great increase can be expected until one or more railroads have made this harbor a lake terminus. There is no probability that the further deepening of Wilson Harbor would lead to such a result.

Any important increase of general commerce at Wilson would be, at least for many years, at the expense of neighboring harbors, and with no economic advantage to the community as a whole. The general commerce of the New York shore of Lake Ontario is at present amply served by the harbors of Lewiston, Olcott, Charlotte, Great Sodus, Little Sodus, and Oswego.

It is the opinion of the Board, in view of the facts above recited, that no increase of existing navigation facilities at Wilson Harbor is advisable.

The depth in the present channel between the lake and the inner end of the piers is 7 feet at standard low water. Experience has shown that this depth, but no greater, is practically self-maintaining.

The superstructure of the piers is rotten, and will soon be broken up by storms. The substructure of timber cribs and stone is not subject to decay, and would endure indefinitely if not broken up by wave action. The cost of duplicating the substructure at present prices would be at least $65,000. When the superstructure has been destroyed the substructure will be without protection above from storms, and in the course of a short time will be broken up.

It can not be denied that changed commercial and economic conditions may again make Wilson the scene of a considerable commerce. For this reason it is highly desirable that the substructure of the present piers should be preserved by means of a low capping of indestructible material, permitting subsequent raising to a height sufficient to serve as an efficient protection to shipping. Based upon a design prepared by the district officer, it is estimated that the cost of a low concrete capping would be about $17 per linear foot, or about $29,000 for both piers. The Board recommends that an early appropriation be made for

**this capping, so that the work may be taken up before the destruc of the piers has proceeded too far, and that when this capping been completed work at this harbor shall cease.**

**Respectfully submitted.**

**Chas. J. Allen,**
***Lieut. Col., Corps of Engine***
**H. F. Hodges,**
***Major, Corps of Engineer***
**Edw. Burr,**
***Major, Corps of Engineer***
**C. H. McKinstry,**
***Captain, Corps of Engineers***
**W. V. Judson,**
***Captain, Corps of Engineers***

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

[First indorsement.]

Office Chief of Engineers, U. S. Army,
*September 18, 1903*

Respectfully returned to the Board of Engineers for Rivers Harbors. * * *

By command of Brig. Gen. Gillespie:

H. F. Hodges,
*Major, Corps of Engineers*

[Second indorsement.]

Board of Engineers for Rivers and Harbors,
*Washington, D. C., November 12, 1903*

Respectfully returned to the Chief of Engineers, United Sta Army.

As stated in the within report the estimate of cost for low concr capping was based upon an estimate prepared by the district offic The latter has lately informed the Board that in view of certain rec experience the estimate should be increased from $17 to $24 per lin foot. At this rate the cost of the work at Wilson would be $40,3 The Board is of opinion that the commerce, present and prospecti of Wilson Harbor is not sufficient to warrant the expenditure of su an amount in protecting the substructure, and therefore recommen that no further work be done at this place.

For the Board:

Chas. J. Allen,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

*Description, facilities, commercial statistics, etc., of harbors on the south shore of Lake Ontario.*

| Locality | Distance from Niagara River. | Depth at standard low water, ordinarily maintained. | Railroads. | Tonnage of freight moved in and out by water annually. | Brief description. |
|---|---|---|---|---|---|
| | *Miles.* | *Feet.* | | | |
| **Burlington Bay, Ontario (Hamilton, Ontario).** | [a]36 | 16 | Grand Trunk | | Parallel piers 116 to 175 feet apart; interior natural landlocked bay; 16 to 18 feet at wharves at Hamilton. |
| **Port Dalhousie, Ontario** | [a]11 | 6 | None | | Entrance to Welland Canal; parallel piers 200 feet apart. |
| **Niagara River, below the Falls.** | | | | | From Lewiston to mouth well sheltered roadstead 7 miles long, about 2,000 feet wide, with 30 to 70 feet of water. On this stretch of river are the ports of Lewiston, Youngstown, and Fort Niagara, N. Y., and Niagara and Queenstown, Ontario. Lewiston Harbor has 16 feet of water, and is reached by the New York Central and Hudson River and the Erie railroads. |
| **Wilson Harbor, New York** | 12 | 7 | None | In 1901, 312 tons | Parallel piers 150 to 170 feet apart. Entrance channel connects with pool at mouth of Twelve-mile Creek, which is 12 feet deep, with 10 feet at warehouse dock. Entrance channel shoals and shifts. |
| **Olcott Harbor, New York** | 18 | 7 | Trolley from Lockport | Very small | Parallel piers 200 feet apart. |
| **Oak Orchard Harbor, New York.** | 45 | 7½ | None | Insignificant | Parallel piers 186 to 190 feet apart. Channel in Oak Orchard Creek 1½ miles long, 70 to 120 feet wide, and 9 to 17 feet deep at standard low water. |
| **Charlotte Harbor, New York.** | 76 | 14½ | New York Central and Hudson River R. R.; Buffalo, Rochester, and Pittsburgh Rwy. | In 1902, 650,000 tons | Parallel piers 450 feet apart. Port of Rochester, N. Y. Inside bar, channel 5 miles long and 18 feet deep. Channel through outer bar shoals and shifts. |
| **Great Sodus, New York** | 108 | 14½ | Pennsylvania R. R | In 1901, 55,000 tons; in 1902, 27,034 tons. | Parallel piers 438–478 feet apart, with breakwaters extending from inner ends to shore. Main part of bay 2½ miles long, ½ to 1½ miles wide, 6 to 7 fathoms deep. Secure anchorage. Entrance channel shoals and shifts. |
| **Little Sodus (Fairhaven), New York.** | 122 | 13½ | Lehigh Valley R. R.; Erie R. R. | In 1901, 150,652 tons; in 1902, 56,000 tons. | Parallel piers 250 feet apart, with breakwaters from inner ends to shore. Bay 2 miles long, one-fourth to five-eighths of a mile wide, depth 4 to 6 fathoms. Entrance channel shifts and shoals. |
| **Oswego, N. Y** | 135 | [b]16½ | New York Central and Hudson River R. R; Delaware, Lackawanna, and Western; New York, Ontario, and Western. | In 1901, 563,588 tons; in 1902, 341,302 tons. | Harbor comprises an outer harbor formed by outer breakwater, an inner harbor formed by inner breakwater, and the lower 3,200 feet of Oswego River. Area of outer harbor, 140 acres, 30 acres having depth not less than 14½ feet, and 33 acres a depth between 14½ and 11½. Holding ground poor; vessels moor to the breakwater. Area of west inner harbor, 4½ acres, depth 13½ feet; 900 feet of mooring room along breakwater. Depths in river, 14½ to 10 feet. |

[a] West.

[b] At entrance to outer harbor and just inside entrance, 30 acres having not less than 14½.

## (B) OAK ORCHARD HARBOR.

### REPORT OF OPERATIONS.

No work was done at this harbor during the fiscal year.

### PROPOSED OPERATIONS AND REMARKS.

The commerce of this port is insignificant, most of the business
excursion and summer resort.

In a letter dated December 2, 1903, transmitting to the Secretar
War the report of the Board of Engineers for Rivers and Harbor
Oak Orchard Harbor (printed in H. Doc. No. 208, 58th Cong..
sess., and herewith) the Chief of Engineers states:

> * * * In view of the facts recited in its report and in the fourth indorse
> thereon, the Board recommends that no further work be done at Oak Orchard
> bor. I concur in this recommendation.
>
> I recommend that this letter and the accompanying report be transmitted t
> Speaker of the House of Representatives for the information of Congress. * *

The channel fills in and should be dredged annually to keep
required depth and width. The piers are decayed and need repair
The channel is now, however, 9½ feet deep at low water for a wi
of 75 feet between the piers. At the ends of the piers, where r
excavation ceased, the depth over rock is 9¾ feet at low water. At
stage of water prevailing during the first half of the season of 19
viz, mean lake level, there was an available depth of 11½ to 12 feet
the channel 75 feet wide.

This narrow channel has maintained itself to its present depth wi
out dredging for some ten years, the last dredging having been d
in 1890–1892, when the channel was reported to be 13½ feet dee
mean lake level (width not reported, but believed to have been 100 fe
A moderate amount of dredging will maintain this channel, whic
sufficient for the present needs of this port, and the piers can also
maintained intact, but not secure against violent storms, for a year
two longer at a moderate cost.

Assuming that the harbor is to be maintained by the Governme
it is estimated that $3,000, in addition to the amount available,
be required for maintenance for the next fiscal year.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1, 41 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | |
| July 1, 1904, balance unexpended | 1, 40 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 3, 00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| July 4, 1836 | $5,000 | June 18, 1878 | $2,000 |
| March 3, 1837 | 5,000 | March 3, 1879 | 1,000 |
| July 7, 1838 | 5,000 | June 14, 1880 | 500 |
| June 11, 1844 | 5,000 | August 2, 1882 | 3,000 |
| August 30, 1852 | 10,500 | July 5, 1884 | 5,000 |
| March 2, 1867 | 87,000 | August 5, 1886 | 12,500 |
| July 11, 1870 | 8,000 | August 11, 1888 | 6,000 |
| March 3, 1871 | 10,000 | September 19, 1890 | 5,000 |
| June 19, 1872 | 2,500 | June 13, 1902 (allotment July 16, 1902) | 2,250 |
| March 3, 1873 | 10,000 | | |
| June 23, 1874 | 10,000 | Total | 207,250 |
| March 3, 1875 | 10,000 | | |
| August 14, 1876 | 2,000 | | |

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### COMMERCIAL STATISTICS OF OAK ORCHARD, N. Y.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from foreign ports. | | Departures to foreign ports. | |
|---|---|---|---|---|
| | No. | Tons. | No. | Tons. |
| Steam | | | | |
| Sail and barges | 6 | 290 | 6 | 290 |
| Total | 6 | 290 | 6 | 290 |

| | |
|---|---|
| Total arrivals and departures (tonnage 580) | 12 |
| Amount of revenue collected year ending December 31, 1903 | $403 |
| Value of imports year ending December 31, 1903 | $4,215 |
| Greatest draft of vessels ... feet.. | 10 |

*Receipts by lake, 1901, 1902, and 1903.*

[Net tons.]

| | 1901. | 1902. | 1903. |
|---|---|---|---|
| Posts | 200 | 322 | 250 |
| Laths | 24 | ........ | 28 |
| Shingles | 116 | 96 | 167 |
| Total | 340 | 418 | 445 |

Shipments by lake, none.

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## REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS RELATIVE TO THE ADVISABILITY OF CONTINUING THE WORK OF IMPROVEMENT AT OAK ORCHARD HARBOR, NEW YORK, OR OF MODIFYING THE PROJECT THEREFOR.

[Printed in House Doc. No. 208, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 2, 1903.*

Sir: By letter dated April 25, 1903, there was transmitted to this office by the chairman of the Committee on Rivers and Harbors of the

It is the opinion of the Board, in view of the facts above recited, that no increase of existing navigation facilities at Oak Orchard Harbor is advisable.

While the present commerce of Oak Orchard Harbor is insignificant, and while there are no probable changes in economic conditions, sufficiently imminent and encouraging to warrant at the present time the further improvement of this harbor, yet the possibility of such changes can not be denied. Should they occur it is important that as much advantage as possible may be taken of work already done. To this end it is inadvisable to abandon the substructure of the piers to complete destruction. This substructure will last indefinitely provided it is protected from piecemeal cutting down by the waves after the superstructure has rotted and been washed away. Based upon an estimate prepared by the district officer for similar piers at Wilson, N. Y., the cost of placing a low concrete capping susceptible of being raised later to any desired height will be about $39,000. The Board recommends that an early appropriation be made for this capping and, this capping having been provided, that no further work be done at this harbor.

Respectfully submitted.

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers.*
H. F. HODGES,
*Major, Corps of Engineers.*
EDW. BURR,
*Major, Corps of Engineers.*
C. H. MCKINSTRY,
*Captain, Corps of Engineers.*
W. V. JUDSON,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 18, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors for further consideration.

* * * * * * *

By command of Brig. Gen. Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Fourth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., November 12, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

As stated in the within report, the estimate of cost for low concrete capping was based upon an estimate prepared by the district officer. The latter has lately informed the Board that in view of certain recent experience the estimate should be increased from $17 to $24 per linear foot. At this rate the cost of the work at Oak Orchard would be $55,440. The Board is of opinion that the commerce, present and prospective, of Oak Orchard is not sufficient to warrant the expenditure of such an amount in protecting the substructure, and therefore recommends that no further work be done at this place.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## R R 2.

## IMPROVEMENT OF OLCOTT HARBOR, NEW YORK.

### REPORT OF OPERATIONS.

Three cast-iron mooring cleats were fastened upon the east pier to take the place of wooden timber heads which had become rotten and broken, and an open joint between the inner end of the west pier and the sheet-pile bulkhead, which temporarily closes a breach in that pier, was closed by driving in a piece of timber and filling the hole caused by the wash with stone, brush, and gravel.

The repairs were begun November 12 and were completed November 15, 1903.

### PROPOSED OPERATIONS AND REMARKS.

The commerce of Olcott is at present small, but a line of steamers from Olcott to Thousand Island points has been established, and an electric railway line was built to Buffalo in 1900. This is a freight as well as a passenger railroad, and connects with the Erie Railroad and the New York Central and Hudson River Railroad, and handles the freight cars from these roads. Summer hotels have been opened, and Olcott seems destined to become a popular summer resort, as well as a place of commercial importance.

In order to complete the channel of the project and preserve the piers, now much decayed, it is estimated that $20,000 will be required and can be profitably expended during the next fiscal year. Of this sum $5,000 will be needed for completing the channel of the project and for redredging where the channel fills in annually; $5,000 will be needed to repair the most decayed parts of the two piers, and $10,000 will be needed to rebuild the west pier for 200 feet at the inner end. The last item is important and urgent.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $252.24 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 77.95 |
| July 1, 1904, balance unexpended | 174.29 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 20,000.00 |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 2, 1867 | $60,000 | March 3, 1881 | $3,000 |
| July 11, 1870 | 10,000 | August 5, 1886 | 10,000 |
| March 3, 1871 | 5,000 | August 11, 1888 | 5,000 |
| June 10, 1872 | 10,000 | September 19, 1890 | 30,000 |
| March 3, 1873 | 10,000 | June 13, 1902 | 15,000 |
| June 23, 1874 | 10,000 | | |
| March 3, 1875 | 10,000 | Total | 178,000 |

---

### COMMERCIAL STATISTICS FOR OLCOTT, N. Y.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 8 | 1,801 | 9 | 2,741 | 8 | 1,818 | 16 | 6,297 |
| Sail and barges | | | 1 | 480 | | | 1 | 480 |
| Total | 8 | 1,801 | 10 | 3,221 | 8 | 1,818 | 17 | 6,777 |

| | |
|---|---|
| Total arrivals and departures (tonnage 13,617) | 43 |
| Amount of revenue collected year ending December 31, 1903 | $22.50 |
| Value of imports year ending December 31, 1903 | $4,854.00 |
| Value of exports year ending December 31, 1903 | None |
| Greatest draft of vessels ... feet.. | 9 |

*Receipts by lake.*

[Net tons.]

| Articles. | 1901. | 1902. | 1903. |
|---|---|---|---|
| Lumber, logs, etc | 375 | 477 | 1,760 |

Shipments by lake, none; about 5,000 passengers arrive and depart by water annually.

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## R R 3.

## IMPROVEMENT OF HARBOR AT CHARLOTTE, NEW YORK.

### REPORT OF OPERATIONS.

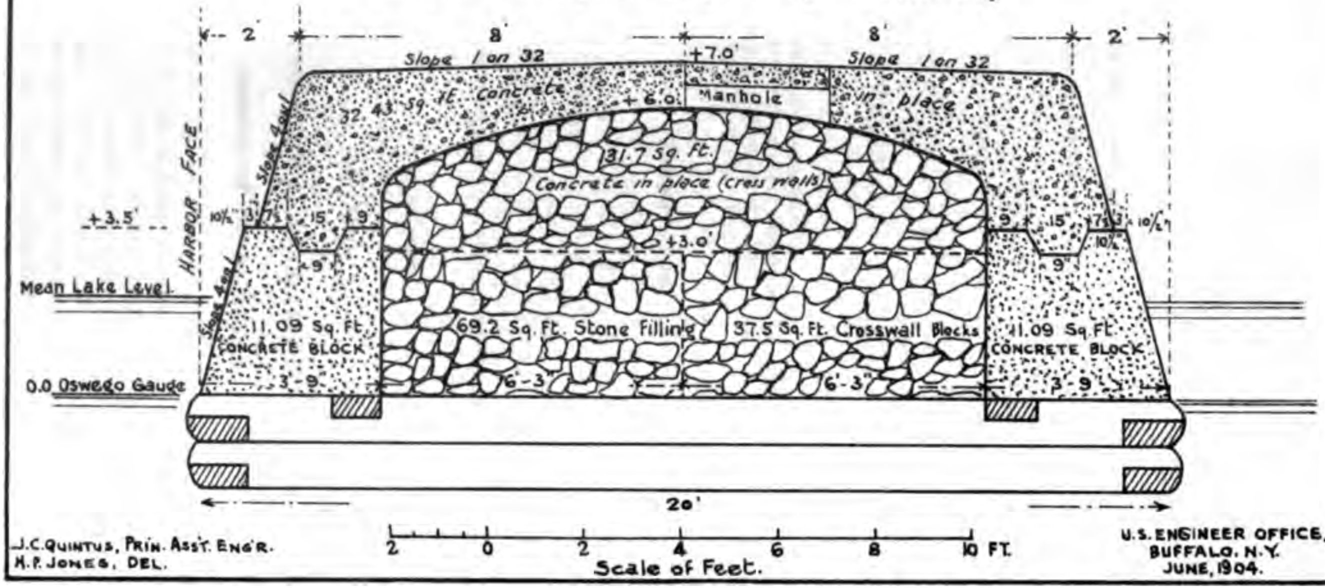
*Concrete superstructure on west pier.*—The abandonment of the modification of project to narrow the channel to 200 feet by means of 3,600 linear feet of brush mattress and stone ballast, at an estimated cost of $15,000, having been authorized by letter of the Chief of Engineers dated January 24, 1903, and the fund of $15,000 turned over to maintenance, plans and preparations were made for rebuilding about 400 feet of the most decayed superstructure of the west pier with concrete. This work was authorized to be done by day's labor. At the beginning of the fiscal year a concrete mixer had been purchased and

## CHARLOTTE HARBOR, N.Y.

CONCRETE SUPERSTRUCTURE ON WEST PIER.

301.5 LIN. FEET BUILT IN 1903.

To accompany annual report for 1904,
of Maj. Theo. A. Bingham, Corps of Engineers, U.S. Army.



J.C. QUINTUS, PRIN. ASST. ENG'R.
H.P. JONES, DEL.

U.S. ENGINEER OFFICE,
BUFFALO, N.Y.
JUNE, 1904.

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON D.C.

the preparatory work advanced. During the month of July the preparatory work was completed. This consisted of putting up complete a derrick scow for handling concrete blocks weighing 9 tons, making and setting up 13 molds for the concrete blocks, installing concrete mixer on scow and loading on scows at Little Sodus Bay 156 cubic yards of beach gravel and sand for making concrete.

The work of tearing out the old decayed superstructure was begun August 4, 1903, at station 1255, west pier, about 50 feet inshore of lake shore line, and then carried lakeward. As the tearing out advanced the work of leveling and repairing the timber crib substructure at the level of low water (zero of the Oswego and Charlotte gauges) was carried on. This work was greatly retarded due to the high stage of water and the muddy condition of the water, which made it impossible to see the work two or more feet under water, and required the employment of divers to fit and fasten and level most of the timbers put in to form the required bearing surface for concrete blocks. The crib substructure was found to be of poor construction (it was built in 1829–1834) necessitating much unlooked-for repair work. In the case of two cribs, 30 feet long each, it was necessary to remove the harbor walls to the depth of 5 to 7 feet below low water and build and set in place new crib work.

The inner end of the work was about 50 feet inshore from the lake-shore line, and when the superstructure was removed much trouble was also caused by sand being thrown in by waves over the newly prepared foundation, requiring repeated cleaning off of sand before the concrete blocks could be set in place. The total length of pier rebuilt with concrete was 301.5 linear feet, and the cost of tearing out the old work and preparing the crib substructure for a foundation for concrete blocks was $19.28 per linear foot. The making of concrete blocks, setting them in place, replacing stone filling, and making the concrete deck over the blocks and stone filling was carried on as the foundation work progressed.

The design of the concrete superstructure is shown on the drawing herewith. All of the concrete blocks and concrete in place was made of 1 part Lehigh Portland cement, 2½ parts sand, and 6¼ parts beach gravel and stone. This beach gravel and stone was found by test to run quite uniformly, 2 parts gravel passing through a screen of 1-inch mesh and catching on a screen of 1¼-inch mesh, and 4¼ parts stone from 1 inch to 2 inches in diameter.

The concrete was found, by test of two blocks of 1 cubic foot each, to weigh 153 pounds to the cubic foot.

The concrete superstructure over the length of pier of 301.5 feet was completed on November 27, 1903, at a total cost for labor and materials, repairs to plant, etc., but exclusive of the cost of concrete mixer and derrick and derrick machinery, of $12,663.41, or $42 per linear foot. This cost is itemized as follows:

| | |
|---|---|
| Removing old superstructure and leveling and repairing crib substructure, per linear foot, $19.28 | $5,812,92 |
| Concrete blocks, making and placing, 58 blocks, 248.2 cubic yards, $12.30 per cubic yard | 3,051.55 |
| Replacing stone filling between blocks, and incidentals | 597.07 |
| Concrete in place, including making and placing forms, manhole covers, 427.8 cubic yards, $7.484 per cubic yard | 3,201.87 |
| Total | 12,663.41 |

*Repairs, west pier.*—All of the deck and some of the wall timbers of the west pier, from the chain ferry at station 6 to station 1255, 655 linear feet, was renewed in July, 1903; 16,380 feet B. M. of timber and plank were placed, at a cost of $574.26 for labor and materials.

During October, November, and December, 1903, the deck of the west pier was repaired from station 1556 to station 1800, and the harbor wall repaired at station 1556. Ten thousand seven hundred and ten feet B. M. of hemlock timber and plank were placed, at a cost of $417.43 for labor and materials.

In April, 1904, minor repairs were made to the decking between station 5 and station 9, at a cost of $99.56 for labor and materials. Nine hundred and twelve feet B. M. of hemlock timber used.

In May, 1904, minor repairs—replacing deck plank washed out and broken—were made, station 1700 to outer end, at a cost of $69.69 for labor and materials.

The total cost of work done on the west pier during the fiscal year was as follows:

| | |
|---|---|
| New concrete superstructure | $12,663.41 |
| Repairs on timber crib pier | 1,160.94 |
| Total | 13,824.35 |

*Repairs, east pier.*—During October, November, and December, 1903, the deck cross-ties and plank were renewed where necessary between stations 1000 and 2800 east pier, at a cost of $427.44 for labor and materials.

In March, 1904, the outer end of the east pier was damaged by ice, threatening the safety of the light-house located there. Repairs were made in April and May, 1904, consisting of replacing the two upper courses of superstructure across the end and northeast corner of the pier, raising the whole end for 20 feet of pier by adding a course of new timber and relaying the deck, at a cost of $180.22 for labor and materials.

Minor repairs, consisting of replacing broken and decayed deck plank along this pier, were also made, at a cost of $69.69.

The total cost of work done on the east pier during the fiscal year was $677.35; all for repairs on timber-crib pier. Timber used, 11,623 feet B. M. hemlock.

*Dredging entrance channel.*—The U. S. dredge *Frontenac* began dredging in the entrance channel August 11, 1903, and continued operations, in connection with its employment on the tearing out of old superstructure where replaced with concrete, until October 15, 1903, when the dredging was completed and the dredge returned to Oswego.

This dredging secured a channel 40 feet wide and 16½ feet deep at low water across the shoal, 700 feet long at the entrance between the piers, and a channel 150 feet wide between the piers, of a depth of 15.7 feet at low water. Twelve thousand eight hundred and thirty-five cubic yards, scow measure, of sand and silt were dredged, at a cost of $2,239.73, or 17.4 cents per cubic yard.

A survey of the channel between the piers was made in April, 1904, and showed that considerable filling in had taken place, so that the limiting depth within the channel width of 150 feet was only 15 feet at low water, and that to restore the channel to the depth required by the project would require the excavation of 30,000 cubic yards, scow measure, of sand, mud, and silt, at an estimated cost of $4,500.

*Examination of pier substructures.*—In May, 1904, an examination of the crib substructures of both piers was made by divers from the shore lines lakeward. The examination showed that 10 cribs, 332 linear feet of the west pier, are in a dangerous condition, due to the crib walls and cross-ties being partly or wholly gone below water down to the depth of 8 feet, and the stone filling washed out to below water level and now lying outside of the cribs.

The remainder of the crib substructure built in 1829–1834, aggregating a length of 2,500 feet, was found to be in a weak and unstable condition, clearly indicating that it must be radically rebuilt in the near future. The cost of this examination was $86.05.

The care of public property and enforcement of harbor regulations were continued throughout the fiscal year.

Water-level observations were continued to February 11, 1904, when they were discontinued and the charge of water-level observations on Lake Ontario transferred to the United States Lake Survey, in conformity with instructions by Department letter of January 13, 1904.

## PROPOSED OPERATIONS AND REMARKS.

Charlotte is the lake port of Rochester and has a large commerce in coal brought by rail from Pennsylvania mines and shipped down the St. Lawrence River and to Canadian ports on Lake Ontario.

Its commerce is large and growing, and the maintenance of its harbor to the full extent of the project is advisable.

The channel maintained between the piers and to deep water in the lake is 3,800 feet long, and requires redredging annually on account of filling, caused by deposit during high water in the Genesee River of material in suspension, and also because of sand drifting into the channel from the lake.

The crib substructure underlying about 2,900 feet of the piers was built in 1829–1834, and is of such poor construction that the crib-wall timbers are gradually being washed out to the depth of about 10 feet below water, placing the piers in a dangerous condition.

The timber superstructure of the piers is also becoming exceedingly rotten. Extensive repairs must be made or the piers will collapse.

Between July and December, 1904, urgent dredging of the entrance channel will be done and the most dangerous portion of the west pier, 332 linear feet, will be rebuilt under special allotment of $23,000 from the appropriation carried by emergency river and harbor act of 1904.

It is estimated that 2,500 feet of the piers should be torn out to below the wrecked crib work, new crib work put in, and then covered with a concrete superstructure, without unnecessary delay. The piers are well settled down, but require extensive repairs to the crib substructure, and should, when repaired, receive concrete superstructure instead of being rebuilt with wood. This will cost, it is estimated, $55 per linear foot, or $137,500. This concrete work would be of the same design as the concrete superstructure now built on the west pier, which is of a design suitable for not only the piers at Charlotte, but for the entrance piers at all of the harbors on Lake Ontario, except Oswego.

For ordinary maintenance and dredging there will be required $7,500, making the total amount required for the next fiscal year $145,000.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $21,518.84 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | 23,000.00 |
| | 44,518.84 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 19,586.45 |
| July 1, 1904, balance unexpended | 24,932.39 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 145,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

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#### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| May 23, 1828 | $300.00 | March 3, 1875 | $5,000.00 |
| March 2, 1829 | 10,000.00 | June 18, 1878 | 1,000.00 |
| March 3, 1829 | 13,335.00 | March 3, 1879 | 1,000.00 |
| March 2, 1831 | 16,670.00 | June 14, 1880 | 5,000.00 |
| February 24, 1832 | 16,000.00 | March 3, 1881 | 2,500.00 |
| March 2, 1833 | 15,000.00 | August 2, 1882 | 35,000.00 |
| June 28, 1834 | 20,000.00 | July 5, 1884 | 20,000.00 |
| March 3, 1835 | 2,390.00 | August 5, 1886 | 26,250.00 |
| July 2, 1836 | 20,000.00 | August 10, 1888 | 45,000.00 |
| March 3, 1837 | 10,000.00 | September 19, 1890 | 25,000.00 |
| July 7, 1838 | 25,000.00 | July 13, 1892 | 25,000.00 |
| June 11, 1844 | 10,000.00 | August 18, 1894 | 15,000.00 |
| August 20, 1852 | 20,000.00 | June 3, 1896 | 12,000.00 |
| March 3, 1853 | 176.10 | March 3, 1899 | 7,000.00 |
| June 28, 1864 | 25,000.00 | June 6, 1900 | [a]3,500.00 |
| June 23, 1866 | 75,607.30 | June 13, 1902 | 30,000.00 |
| July 25, 1868 | 1,100.00 | April 28, 1904 | 23,000.00 |
| April 10, 1869 (allotment) | 1,000.00 | | |
| July 11, 1870 | 12,000.00 | Total | 584,828.40 |
| March 3, 1871 | 10,000.00 | | |

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#### COMMERCIAL STATISTICS OF CHARLOTTE HARBOR, NEW YORK.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 201 | 124,777 | 530 | 479,012 | 177 | 111,626 | 554 | 492,163 |
| Sail and barges | 101 | 26,940 | 346 | 110,977 | 35 | 7,791 | 412 | 130,126 |
| Total | 302 | 151,717 | 876 | 589,989 | 212 | 119,417 | 966 | 622,289 |

| | |
|---|---|
| Total arrivals and departures (tonnage, 1,483,412) | 2,356 |
| Decrease of tonnage, 1903 under 1902 | 39,856 |
| Amount of revenue collected, year ending December 31, 1903 | $5,019.04 |
| Value of imports, year ending December 31, 1903 | $45,698.00 |
| Value of exports, year ending December 31, 1903 | $1,775,205.48 |
| Greatest draft of vessels feet | 16 |
| Enrolled tonnage, port of Charlotte gross tons | None. |

---

[a] Unexpended balance of $41.24 returned into Treasury.

*Receipts by lake.*

[Net tons.]

| | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|
| Poles and railroad ties | 6,805 | 1,115 | 6,352 | 3,451 | 406 |
| Lumber | 245 | 585 | 61 | 546 | 707 |
| Posts, logs, and pulp wood | 2,401 | 513 | 2,974 | 4,868 | 5,215 |
| Lath | 319 | ........ | 255 | 209 | 181 |
| Shingles | 18 | 14 | 99 | 238 | 75 |
| Merchandise | 140 | 250 | 483 | 27 | 1,774 |
| Total | 9,928 | 2,477 | 10,224 | 9,339 | 8,358 |

*Shipments by lake.*

[Net tons.]

| | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|
| Coal | 437,246 | 397,032 | 538,843 | 547,850 | 560,081 |
| Oils and merchandise | 231 | 96 | 140 | 501 | 730 |
| Total | 437,477 | 397,128 | 538,983 | 548,351 | 560,811 |

About 50,000 passengers arrive and depart by water annually.

## R R 4.

## IMPROVEMENT OF HARBOR AT GREAT SODUS BAY, NEW YORK.

### REPORT OF OPERATIONS.

No operations were carried on at Great Sodus Bay during the season of 1903.

An examination of the entrance channel and piers made in April, 1904, showed that the entrance channel had shoaled so that the controlling depth was only 12½ feet at low water. To meet the requirements of navigation, it was important and urgent that the entrance channel should be restored to the depth required by the project, of 15 feet at low water, in the channel 150 feet wide between the piers. This involved the dredging of 800 feet of the channel inward from the end of the west pier, and 500 feet lakeward therefrom, requiring the removal of 18,000 cubic yards, scow measure, of sand and silt, at an estimated cost of $2,700, with contingencies of $250, making a total of $2,950.

The examination also showed that the piers needed repairs, no work having been done on them since 1902. The deck planking was very rotten and much of it badly broken. Repairs were urgent to insure the safety of the piers, at an estimated cost of $1,000, including contingencies.

The amount required for urgent work was therefore $3,950, which amount was $1,250 more than the balance of funds available. The needed balance was allotted from the appropriation carried by the emergency river and harbor act approved April 28, 1904.

Dredging of the channel was begun with the U. S. dredge *Frontenac* on May 24, 1904, and was still in progress at the close of the fiscal year.

The shoalest part of the channel, 1,200 feet long (900 feet inward and 300 feet lakeward from the end of the west pier) had then been dredged 100 to 70 feet wide and 15 feet deep at low water.

Ten thousand and forty-five cubic yards, scow measure, of sand and silt were removed at a cost of 12.6 cents per cubic yard.

Repairs on the piers were begun June 1, 1904, and carried on to June 20, 1904, when operations were suspended until timber and plank could be obtained. Decayed and broken deck plank were replaced where most needed on both piers, at a cost for labor and materials of $370.88.

### PROPOSED OPERATIONS AND REMARKS.

The channel between the piers to be maintained is 1,800 feet long and 150 feet wide from the bay to the 15-foot curve in Lake Ontario, and requires more or less dredging annually on account of shoaling, chiefly caused by the drifting in of sand from the lake. Besides the maintenance of the channel, there are 2,150 feet of breakwater and 2,874 feet of piers to be maintained. These structures are all old timber-crib work in an advanced stage of decay, and require constant extensive repairs to maintain them. They should be rebuilt with concrete superstructure in the near future.

It is estimated there will be required for the ensuing fiscal year for maintenance of channel and repairs to piers $5,000.

The commerce of this port is not large, consisting chiefly of the shipment of coal brought from Pennsylvania mines by rail.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,841.42 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | 1,250.00 |
| | 4,091.42 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 1,516.28 |
| July 1, 1904, balance unexpended | 2,575.14 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 5,000.00 |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 2, 1829 | $12,500.00 | June 18, 1878 | $5,000.00 |
| March 3, 1829 | 15,280.00 | March 3, 1879 | 2,000.00 |
| March 2, 1831 | 17,450.00 | June 14, 1880 | 3,000.00 |
| February 24, 1832 | 17,000.00 | March 3, 1881 | 5,000.00 |
| March 2, 1833 | 15,000.00 | August 2, 1882 | 25,000.00 |
| June 28, 1834 | 15,000.00 | July 5, 1884 | 10,000.00 |
| March 3, 1835 | 11,790.00 | August 5, 1886 | 16,875.00 |
| July 2, 1836 | 12,600.00 | August 10, 1888 | 24,000.00 |
| March 3, 1837 | 12,000.00 | September 19, 1890 | 10,000.00 |
| July 7, 1838 | 10,000.00 | July 13, 1892 | 15,000.00 |
| June 11, 1844 | 5,000.00 | August 18, 1894 | 15,000.00 |
| August 20, 1852 | 10,000.00 | June 3, 1896 | 8,000.00 |
| June 23, 1866 | 53,151.80 | March 3, 1899 | 14,000.00 |
| March 2, 1867 | 80,000.00 | July, 1899 (repayment) | 1.00 |
| July 11, 1870 | 5,000.00 | June 13, 1902 | 5,000.00 |
| June 10, 1872 | 15,000.00 | June 13, 1902 (allotment) | 1,250.00 |
| June 23, 1875 | 15,000.00 | | |
| March 3, 1875 | 10,000.00 | Total | 495,897.80 |
| August 14, 1876 | 5,000.00 | | |

### COMMERCIAL STATISTICS.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 10 | 1,733 | 18 | 2,674 | 9 | 1,665 | 18 | 2,455 |
| Sail and barges | 10 | 2,385 | 34 | 7,807 | 19 | 3,815 | 28 | 8,070 |
| Total | 20 | 4,118 | 52 | 10,481 | 28 | 5,480 | 46 | 10,525 |

| | |
|---|---|
| Total arrivals and departures (tonnage 30,604) | 146 |
| Decrease of tonnage, 1903 under 1902 ....tons.. | 3,031 |
| Amount of revenue collected year ending December 31, 1903 | $8.76 |
| Value of imports, year ending December 31, 1903 | $11,588.90 |
| Value of exports, year ending December 31, 1903 | $103,256.00 |
| Greatest draft of vessels ....feet.. | 13½ |
| Enrolled tonnage | None. |

*Receipts and shipments by lake.*

[Net tons.]

| | Receipts. | | | Shipments. | | |
|---|---|---|---|---|---|---|
| | 1901. | 1902. | 1903. | 1901. | 1902. | 1903. |
| Coal | | | | 54,598 | 21,251 | 13,597 |
| Poles and railroad ties | 100 | 375 | | | | |
| Posts, lumber, etc | | | | | | |
| Merchandise | | 3 | 3 | | | 13 |
| Feldspar | 3,037 | 5,097 | 5,262 | | | |
| Total | 3,137 | 5,475 | 5,265 | 54,598 | 21,251 | 13,610 |

Several thousand passengers arrive and depart by water annually.

## R R 5.

## IMPROVEMENT OF HARBOR AT LITTLE SODUS BAY, NEW YORK.

### REPORT OF OPERATIONS.

The river and harbor act of June 13, 1902, provided for the extension of the east pier 300 feet lakeward. On June 2, 1903, the contractors for the extension of the east pier began the operations by dredging of foundations, which was completed June 3, 1904. At the beginning of the fiscal year the contractors were about ready to begin the construction of the timber cribs for the timber-crib concrete structure to be built under the contract in force for the whole extension of 300 feet.

The foundation for 200 linear feet was leveled by divers removing loose stone over the hardpan bottom to the required depth of 12 to 14 feet at low water, zero of Oswego gauge, October 16, 1903.

The construction of cribs for the substructure—three in number—each 100 feet long, was begun July, 1903, and completed November, 1903. The first crib was sunk in place October 17 and the second crib November 11, so that at the close of operations in November, 1903, the cribs were in place for 200 linear feet of the extension, and the third crib ready to sink in place.

Operations were resumed May 16, 1904. The foundation for the third crib was leveled by dredging May 25, and the last crib sunk in place May 26, 1904.

Work preparatory to making concrete blocks, making and setting up molds therefor, breaking beach stone, and collecting gravel and sand for concrete, was carried on in connection with the crib work, and the making of concrete blocks was begun June 9. At the close of the fiscal year 62 concrete blocks had been made ready to set in place on the cribs, and the leveling of the crib timbers to receive the blocks was fairly begun. This leveling is difficult, owing to the high stage of water prevailing in Lake Ontario, and requires the work to be done in 3 to 3½ feet of water.

### PROPOSED OPERATIONS AND REMARKS.

The entrance channel is 2,300 feet in length from the bay to the 15-foot curve in the lake. It requires more or less dredging annually on account of shoaling, caused chiefly by the drifting of sand from the west. Urgent dredging of the channel will be done before November, 1904, under a special allotment of $2,000 from the appropriation carried by the emergency river and harbor act approved April 28, 1904.

Besides the maintenance of this channel there are 4,937 feet of piers and breakwaters to be maintained, viz, the west pier, 1,747 feet; the east pier, 1,510 feet, and the east breakwater, 1,680 feet. The west breakwater is entirely covered by accretions of sand. The piers are much in need of repairs, portions of them being very rotten. The most decayed parts will be repaired before November, 1904, under a special allotment of $2,000 from the appropriation carried by the emergency river and harbor act approved April 28, 1904.

The piers must soon be thoroughly repaired or they will collapse and be carried away by the seas. When these repairs are made it will be advisable to use concrete in place of wood for the superstructures. It is estimated that 2,000 feet of the piers should have their superstructures renewed with concrete in the near future. This will cost $50 per foot, or $100,000.

It is estimated that there will be required for the ensuing fiscal year:

| | |
|---|---|
| For ordinary repairs and dredging | $5,000 |
| For replacing 2,000 feet of wooden superstructure with concrete | 100,000 |
| Total | 105,000 |

The commerce of this port consists chiefly of shipments of coal brought by rail from Pennsylvania mines and destined to Canadian ports on Lake Ontario and the St. Lawrence River.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $21,778.10 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | 2,000.00 |
| | 23,778.10 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 1,394.53 |
| July 1, 1904, balance unexpended | 22,383.57 |
| July 1, 1904, amount covered by uncompleted contracts | 20,116.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 105,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| August 30, 1852 | $10,000.00 | June 14, 1880 | $20,000.00 |
| April 9, 1864 | 1,778.36 | March 3, 1881 | 20,000.00 |
| April 9, 1864 | 2,224.00 | August 2, 1882 | 25,000.00 |
| April 9, 1864 | 99.00 | July 5, 1884 | 10,000.00 |
| June 23, 1866 | 33,840.41 | August 5, 1886 | 12,500.00 |
| March 2, 1867 | 50,000.00 | August 10, 1888 | 16,000.00 |
| April 10, 1869 | 1,500.00 | September 19, 1890 | 13,000.00 |
| July 11, 1870 | 5,000.00 | July 13, 1892 | 6,000.00 |
| March 3, 1871 | 15,000.00 | August 18, 1894 | 8,000.00 |
| June 10, 1872 | 15,000.00 | June 3, 1896 | 8,000.00 |
| March 3, 1873 | 15,000.00 | March 3, 1899 | 5,500.00 |
| June 23, 1874 | 15,000.00 | July, 1899 (repayment) | 1.00 |
| March 3, 1875 | 10,000.00 | June 13, 1902 | 25,000.00 |
| August 14, 1876 | 5,000.00 | June 13, 1902 (allotment) | 2,000.00 |
| June 18, 1878 | 10,000.00 | | |
| March 3, 1879 | 5,000.00 | Total | 385,442.77 |

### CONTRACT IN FORCE.

*Contract for extending the east pier at Little Sodus Bay, New York, dated March 28, 1903.*

Name of contractor: Buffalo Dredging Company.

Rates:

| | |
|---|---|
| Excavation for foundation, for all | $1,000.00 |
| Foundation stone, per cubic yard | 1.60 |
| Timber cribs, per linear foot | 36.00 |
| Stone in superstructure, per cubic yard | 1.50 |
| Hemlock timber, per M feet B. M | 30.00 |
| Concrete blocks, per cubic yard | 11.50 |
| Concrete in place, per cubic yard | 9.00 |
| Manhole covers, each | 5.00 |
| Corner posts for two | 80.00 |
| Mooring posts, each | 10.00 |
| White-oak fender, per linear foot | .70 |

Date of approval: April 7, 1903.
Date of commencement: May 10, 1903.
Date of completion: December 1, 1903.
Time limit waived.

### COMMERCIAL STATISTICS FOR LITTLE SODUS BAY, NEW YORK.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 28 | 2,380 | 82 | 13,675 | 22 | 1,682 | 91 | 16,433 |
| Sail and barges | 24 | 5,422 | 137 | 38,972 | 15 | 2,054 | 151 | 42,859 |
| Total | 52 | 7,802 | 219 | 52,647 | 37 | 3,736 | 242 | 59,292 |

| | |
|---|---|
| Total arrivals and departures (tonnage, 123,477) | 550 |
| Increase of tonnage, 1903 over 1902 ... tons | 62,022 |
| Amount of revenue collected year ending December 31, 1903 | $2,481.08 |
| Value of imports year ending December 31, 1903 | $13,564.50 |
| Value of exports year ending December 31, 1903 | $469,942.00 |
| Greatest draft of vessels ... feet | 14 |
| Enrolled tonnage | None. |

*Receipts and shipments by lake.*

[Net tons.]

| | Receipts. | | | Shipments, | | |
|---|---|---|---|---|---|---|
| | 1901. | 1902. | 1903. | 1901. | 1902. | 1903. |
| Coal | | | | 133,594 | 48,897 | 118,735 |
| Poles and railroad ties | 517.0 | 3,584 | 306 | 12 | | |
| Posts and wood | 995.0 | 62 | 1,250 | | | |
| Fish and miscellaneous | .6 | | | | | 15 |
| Lumber and shingles | | | 386 | | | |
| Total | 1,512.6 | 3,646 | 1,942 | 133,606 | 48,897 | 118,750 |

Several thousand passengers arrive and depart by water annually.

## R R 6.

## IMPROVEMENT OF HARBOR AT OSWEGO, NEW YORK.

### REPORT OF OPERATIONS.

*Repairs to the substructure of outer breakwater.*—This work consisted in repairing incipient breaches in the lake walls of the cribs, and was carried on by submarine divers. At the beginning of the fiscal year work was in progress on breaches at stations 3130 and 3140. These repairs were completed in July, 1903. The stone filling was removed from the crib work to a depth of 14 to 15 feet below water, four corner posts placed in the crib corners, the lake walls drawn to place, and stone filling and decking replaced, at a cost for labor and materials of $521.57 The repair of breaches was then suspended as the divers were needed on work at Charlotte Harbor, New York.

An examination of the substructure was made by divers in May, 1904. Incipient breaches were found in the lake walls of eight cribs, viz, at stations 1200, 1600, 2100, 2300, 2925, 4240, 4340, and 4440, where the crib walls had been drawn out of place from 2 to 10 inches. Cost of examination, $127.39.

The repair of breaches was begun with divers on May 26, 1904, at stations 4440 and 4340. At the close of the fiscal year breaches at stations 4440, 4340, and 4240 had been repaired by placing corner posts in the cribs and drawing in the crib walls in the usual manner, at a cost for labor and materials of $859.64, and repairs were in progress on breaches at stations 2925, 2300, and 2100.

*Repairs to superstructure of outer breakwater.*—During July, 1903, 10 cubic yards of stone were placed in the banquette, stations 1 to 3, decayed and broken deck plank replaced between stations 1 and 47, and the fence of the reservation at the shore arm repaired.

During August repairs were made to the parapet and banquette decks from the gap to the northeast angle of the breakwater and 9½ cubic yards of stone filling placed in the banquette between stations 28 and 32, and during September repairs were made to decks from the gap to the northwest angle and on the shore arm. The repairs to superstructure were completed in September for the season of 1903, at a cost, for labor and material, including repairs to derrick scows, of $1,948.55.

Repair work was resumed in May, 1904. A counterfort crib 20 feet square at station 1300, inner face of breakwater, was so badly decayed that its removal was advisable. The counterfort was torn out by the dredge *Frontenac* to the depth of 16 feet below low-water level, the old timbers disposed of, and the filling stone, about 200 cubic yards, dumped on the breakwater deck. This work was done May 11 to 30. The cost of dredging out the counterfort was $330.33, all expended by the U. S. dredge *Frontenac.*

The stone removed from the counterfort was placed in the superstructure where most needed, and 122 parapet deck plank renewed between stations 700 and 1580, at a cost of $236.30 for labor and materials.

During June the U. S. scow *No. 4* was calked and launched, at a cost of $43.08, and 23,535 feet B. M. of hemlock timber and plank for breakwater repairs received and transported for further work; cost, $441.28.

*Repairs to inner breakwater and light-house pier.*—Repairs on the light-house pier, consisting of rebolting wall timbers and sheet piling that had become loose, were made in October and November, 1903, at a cost, for labor and materials, of $118.03.

An examination of the inner breakwater was made April 1, 1904, and repairs to the deck and inner face walls found necessary. During April, 1904, 4,136 feet B. M. of hemlock deck plank were placed, completing repairs to the deck, at a cost of $186.31. Repairs to face walls were postponed, owing to high stage of water.

*Dredging.*—At the beginning of the fiscal year dredging was in progress with U. S. dredge *Frontenac* on deepening the channel along the breakwater, connecting the deep pools at the eastern and western ends of the outer harbor basin. This dredging was completed in July, 1903, making this channel 100 feet wide and 15.7 feet deep at low water. The amount of material dredged from this channel during July was 6,285 cubic yards, scow measurement, at a cost of 14 cents per cubic yard.

In October, 1903, the inner harbor basin near the United States engineer storehouse was dredged to the depth of 15 feet at low water, 350 cubic yards of sand, etc., being dredged; and in November a small shoal in the entrance channel alongside the light-house pier was removed by dredging 650 cubic yards of sand.

The total amount of dredging done at Oswego Harbor during the fiscal year was 7,285 cubic yards, scow measurement, and the total expenditure for the U. S. dredge *Frontenac*, charged to Oswego for dredging was $1,675.68, which amount includes the cost of labor, supplies, towing, repairs, and laying up of dredge in November, 1903.

*Care of plant and property.*—The floating plant and other property was repaired and cared for. During December, 1903, and January, February, and March, 1904, the floating plant laid up required special watching during storms. In addition, there was required, at times, extra labor to care for property in the storehouses, and in May an old canal boat, sunk at the United States dock at Fort Ontario, was removed. The cost of these items was $403.29.

Water-level observations were continued to February 10, 1904, when they were discontinued and the charge of water-level observations on Lake Ontario transferred to the United States Lake Survey in conformity with instructions by Department letter of January 1: 1904.

*Definition of the project for improvement.*—For many years past tl improvement of the inner harbor in the mouth of the Oswego Riv has been carried on by acts of Congress for the expenditure of avai able balances of appropriations without any definite approved proje The advisability and necessity for the adoption of a definite proje for this part of the improvement became apparent and is fully s forth in the following correspondence:

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., March 28, 1904.*

GENERAL: (1) I have the honor to submit the following matter relating to tl project for the improvement of Oswego Harbor, New York, for the consideration the Department, and would respectfully request a decision of the question involve

(2) The project for the improvement of Oswego Harbor, New York, is at tl present time indefinite so far as "continuing the improvement" is concerned; ar this is especially true of the improvement of the inner harbor lying in the mouth the Oswego River.

(3) There has recently been received at this office a letter from the Oswego Boa of Trade asking that further improvement of the inner harbor be undertaken by tl removal of bed rock, so as to extend the area navigable by vessels of 14 to 15 fe draft at mean water level farther upstream.

(4) Consideration of this inquiry has brought out the fact that the project f improvement of Oswego Harbor is very obscure in the matter of excavation in Oswe River as shown by the history [a] of such excavation and improvement appended heret

(5) The history of the improvement of the inner harbor in the mouth of the Osw River shows that up to 1899 the work was done under special authorization, not und an approved project for improvement, but under special plans worked out from tin to time as the available balance of funds would admit. Since 1899 the precede established by former improvements in the river, and the wording of the acts of 18 and 1902, "continuing improvement," have been taken as sufficient authority to co tinue the improvement in the river; and the removal of a part of the upper islan and deepening of the waters adjacent thereto, has been done accordingly.

(6) The local commercial interests now seek further improvement by deepeni the harbor farther upstream, but it would appear necessary and advisable to have definite project for such work before it is undertaken.

(7) There is submitted herewith a tracing [a] showing the condition of the inn harbor in the mouth of the Oswego River, and also a plan for further deepening, l rock excavation, farther upstream, indicated on the tracing by the area A, Y, B, C, D. This would limit and define the deep-water area (15 feet at zero of Oswego gauge) be improved "farther upstream" as ending on the south line of Seneca street, shown on the tracing. This would give an adequate deep-water area adjacent to tl elevators and coal trestles and wharves for general merchandise, remedy the prese difficulties met with by deep-draft vessels in maneuvering in this vicinity, and ful meet the demands of present commerce and of prospective commerce until the co struction of the 1,000-ton barge canal by the State of New York (one of the termi of which is to be at Oswego) is completed and new conditions enter into the questio This will not be probably for ten years to come.

(8) The plan or project indicated was arrived at after consultation with the nav gation interests. Navigation farther upstream than the south line of Seneca stre is fairly provided for under existing conditions.

(9) On the east side of the river the State of New York has excavated a chann 100 feet wide and 10 feet deep at zero of Oswego gauge. This channel is used in co nection with the New York State canal system and is sufficient for canal boats ar similar vessels using the wharves on the east side of the river and entering or leavi the Oswego Canal through the lock at the south end of this channel.

(10) On the west side of the river the channel is the natural, unimproved riv channel. It is used by passenger steamers, tugs, and sail vessels of not to exceed feet draft. Some of them, on account of the limited depth of water during low-wat periods, strike the rock bottom, but on the whole this natural channel may be co sidered as adequate for present needs; and improvement thereof could not l

---

[a] Omitted from this report.

advisedly undertaken until the effect of the new 1,000-ton barge canal upon the commerce of Oswego is known.

(11) The cost of extending the area of the inner harbor 15 feet deep, at zero of Oswego gauge, to the south line of Seneca street, is estimated as follows:

| | |
|---|---|
| Rock excavation, 9,500 cubic yards, place measurement, at $3 per cubic yard | $28,500 |
| Contingencies and engineering expenses | 2,850 |
| Total | 31,350 |

(12) The most urgent work called for is the removal of the rock from the triangular area A, X, Y, to the depth of 15 feet at zero of the Oswego gauge. This would carry the excavation across the river on the north line of Seneca street, and would add about 12,400 square feet of deep water where it would be very useful, and do away with a serious menace to vessels.

(13) The estimate for the removal of rock within this area A, X, Y, to the depth of 15 feet at zero of the Oswego gauge is:

| | |
|---|---|
| Rock excavation, 2,400 cubic yards, place measurement, at $3 per cubic yard | $7,200 |
| Contingencies and engineering expenses, 10 per cent | 720 |
| Total | 7,920 |

(14) If it is deemed advisable and practicable to approve the project for further improving the inner harbor in the mouth of Oswego River as herein recommended, the matter of doing the urgent work within the limited area A, X, Y, could be considered and probably it could be advantageously done during the present season with funds now available.

Very respectfully, your obedient servant,

P. S. Bond,
*First Lieut., Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A., Washington, D. C.*
(Through Division Engineer, Eastern Division.)

[First indorsement.]

U. S. Engineer Office, Eastern Division,
*New York City, April 2, 1904.*

Respectfully forwarded to the Chief of Engineers, United States Army.

Earl I. Brown,
*First Lieut., Corps of Engineers.*
(In absence of Colonel Stickney, Division Engineer.)

[Second indorsement.]

War Department,
Office of the Chief of Engineers,
*Washington, April 13, 1904.*

Respectfully referred to Col. Amos Stickney, Corps of Engineers, division engineer, eastern division, for remark and recommendation.

To be returned.

A. McKenzie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Third indorsement.]

U. S. Engineer Office, Eastern Division,
*New York City, April 16, 1904.*

1. Respectfully returned to the Chief of Engineers, United States Army.

2. The project for expenditure of $51,000 appropriated by act of June 13, 1902, submitted in letter of Maj. T. W. Symons of June 30, 1902, and approved by Chief of Engineers in letter of July 10, 1902, contemplated repair work of outer breakwater, dredging channels which had shoaled, and maintenance of inner breakwater.

3. The work actually performed during fiscal year ending June 30, 1903 (see Annual Report of the Chief of Engineers for 1903) and since June 30, 1903 (see monthly reports of operations) has included work as laid out in project.

4. The estimate submitted in Major Symons's annual report of 1901, upon which

the appropriation of 1902 may be supposed to have been based, contained an item of $25,000 for continuing rock excavation in river.

5. Under previous appropriations considerable rock excavation in the lower part of the river had been accomplished, and the letter of Hon. W. B. Hooker, former chairman of the River and Harbor Committee, dated January 18, 1897, addressed to the Chief of Engineers (see history of excavation, etc., in inclosure herewith) appears to indicate the intention of Congress to consider the lower part of the river as a part of the harbor, the upstream limit of which was not fixed.

6. In my opinion it would be justifiable to assume a reasonable line for the upstream limit of the harbor, say a line crossing the dike extending below the bridge, at which point the narrower channel of the river would begin; the extension of the excavation up to the dike being made only when the commercial interests required it, and funds were available.

7. The excavation already extends on the east side above the north line of Seneca street, and the excavation of the area marked "A, X, Y," on the tracing herewith, would be advantageous.

8. The latest information in this office, contained in monthly report of operations for December, 1903, showed a balance on hand for this harbor of $31,266.11. Small expenditures have probably been made since. The estimated cost of excavating the area A, X, Y is $7,920. This would leave probably not less than $20,000, which amount could be reserved for a possible emergency in damage to the breakwater.

9. In view of the above, I would recommend the excavation of the area A, X, Y, if, in the opinion of the district officer, there is no more urgent work for which the money should be expended.

AMOS STICKNEY,
*Colonel, Corps of Engineers,*
*Division Engineer.*

[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, April 20, 1904.*

1. Respectfully returned to Lieutenant Bond, approved, for the excavation, with available funds, of the area A, X, Y, as recommended by the division engineer.

2. Lieutenant Bond is requested to present in his next annual report the facts and his recommendation in regard to the upstream limit of the improvement in the river, with the view to further action by Congress.

To be returned.

By command of Brig. Gen. Mackenzie:

H. F. HODGES,
*Major, Corps of Engineers.*

It will be noted that in paragraph 6 of the third indorsement the division engineer states:

> In my opinion it would be justifiable to assume a reasonable line for the upstream limit of the harbor, say a line crossing the dike extending below the bridge, at which point the narrower channel of the river would begin; the extension of the excavation up to the dike being made only when the commercial interests required it, and funds were available.

This opinion is at variance with the recommendation given and explained in the letter (pars. 7-11) and has led to a further consideration of the extent of navigable waters needed for existing navigation interests.

As stated in the letter, it is proposed to limit the projected excavation for the whole width of the river to the south line of Seneca street.

In partial conformity with the views of the division engineer, it is now also deemed advisable to provide for the navigation interests along the west bank above Seneca street by excavating a channel 400 feet long and 100 feet wide to the depth of the project, viz, 15 feet at low water to the north line of Cayuga street, or to the end of the dike on the west side of the river.

The recommendation of the division engineer that the excavation be carried to this limit (the north line of Cayuga street) for the whole width of the river, is not concurred in, for the reason that the current in the center of the river is too swift for navigation, and because the interests of navigation, existing and prospective, do not appear to justify the cost of such extensive rock excavation.

The estimated cost of deepening the river for its whole width to the south line of Seneca street is, as stated in the letter, $31,350.

The estimated cost of excavating a channel 400 feet long and 100 feet wide along the west bank to the north line of Cayuga street is as follows:

| | |
|---|---|
| Rock excavation, 8,500 cubic yards, place measure, at $3 per cubic yard | $25,500 |
| Contingencies and engineering expenses, 10 per cent | 2,550 |
| Total | 28,050 |

The total estimated cost is therefore $59,400.

It is recommended that the project for the improvement of Oswego Harbor be defined by Congress so that the improvement of the harbor in the mouth of Oswego River shall require the deepening of the Oswego River for its full width between established harbor lines to 15 feet at low water up to the south line of Seneca street, and for a length of 400 feet and a width of 100 feet, along the west bank, to 15 feet at low water, thence to the north line of Cayuga street, at an estimated cost of $59,400.

### PROPOSED OPERATIONS AND REMARKS.

It is estimated that there will be required for the ensuing fiscal year:

| | |
|---|---|
| For continuing improvement by rock excavation in river | $25,000 |
| For maintenance and contingencies, exclusive of outer breakwater | 10,000 |
| Total | 35,000 |

No estimate is made for repairs to outer breakwater, as the character and extent of future work on this structure is understood to rest upon the action of Congress upon the report on a preliminary examination and survey submitted to Congress December 8, 1903, and printed in House Document No. 55, Fifty-eighth Congress, second session.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $40,131.12 |
| Received from sales | | 68.00 |
| | | 40,199.12 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 11,806.80 |
| July 1, 1904, balance unexpended | | 28,392.32 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $25,000.00 | |
| For maintenance of improvement | 10,000.00 | |
| | | 35,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

APPROPRIATIONS.

| | |
|---|---|
| March 20, 1826 | $200.00 |
| March 2, 1827 | 33,348.64 |
| May 19, 1828 | 9,583.39 |
| March 3, 1829 | 7,472.00 |
| March 2, 1831 | 2,812.92 |
| March 2, 1831 | 18,600.00 |
| March 2, 1831 | 519.00 |
| March 2, 1831 | 84.92 |
| February 24, 1832 | 19,000.00 |
| March 2, 1833 | 8,400.00 |
| June 28, 1834 | 30,000.00 |
| July 2, 1836 | 20,000.00 |
| March 3, 1837 | 15,000.00 |
| July 7, 1838 | 46,067.00 |
| June 11, 1844 | 20,000.00 |
| August 20, 1852 | 40,000.00 |
| August, 1860 (allotment transferred from light-house) | 30,000.00 |
| June 28, 1864 (allotment) | 25,000.00 |
| June 23, 1866 | 45,000.00 |
| March 2, 1867 | 60,000.00 |
| July 25, 1868 (allotment) | 20,000.00 |
| April 10, 1869 | 22,275.00 |
| April 10, 1869 | 6,000,00 |
| July 11, 1870 | 50,000.00 |
| March 3, 1871 | $100,000.00 |
| June 10, 1872 | 100,000.00 |
| March 3, 1873 | 100,000.00 |
| June 3, 1874 | 75,000.00 |
| March 3, 1875 | 90,000.00 |
| August 14, 1876 | 90,000.00 |
| June 18, 1878 | 90,000.00 |
| March 3, 1879 | 90,000.00 |
| June 14, 1880 | 90,000.00 |
| March 3, 1881 | 50,000.00 |
| August 2, 1882 | 80,000.00 |
| July 5, 1884 | 80,000.00 |
| August 6, 1886 | 71,250.00 |
| August 10, 1888 | 100,000.00 |
| September 19, 1890 | 30,000.00 |
| July 13, 1892 | 40,000.00 |
| August 18, 1894 | 37,000.00 |
| June 3, 1896 | 60,000.00 |
| March 3, 1899 | 60,000.00 |
| March 22, 1901 (allotment) | 10,000.00 |
| June 13, 1902 | 51,000.00 |
| 1904 (sales) | 68.00 |
| Total | 2,023,680.87 |

COMMERCIAL STATISTICS FOR OSWEGO, N. Y.

*Arrival and departure of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 91 | 30,242 | 430 | 136,835 | 121 | 58,063 | 394 | 105,980 |
| Sail and barges | 178 | 50,901 | 471 | 126,555 | 107 | 24,706 | 551 | 150,061 |
| Total | 264 | 81,143 | 901 | 263,390 | 228 | 82,769 | 945 | 256,061 |

| | |
|---|---|
| Total arrivals and departures (tonnage, 683,363) | 2,338 |
| Increase of tonnage, 1903 over 1902 ... tons | 383,061 |
| Amount of revenue collected, year ending December 31, 1903 | $62,956.59 |
| Value of imports, year ending December 31, 1903 | $493,503.60 |
| Value of exports, year ending December 31, 1903 | $2,153,134.00 |
| Greatest draft of vessels ... feet | 14 |
| Enrolled tonnage, port of Oswego ... gross tons | 26,751 |

*Receipts by lake.*

[Net tons.]

| Articles. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|
| Lumber | 66,954 | 69,216 | 72,744 | 60,790 | 49,662 |
| Poles and railroad ties | 19,534 | 3,667 | 563 | 6,861 | 832 |
| Posts, pulp wood, etc | 8,638 | 919 | 2,328 | 26,639 | 37,001 |
| Shingles | 5,155 | 3,361 | 2,826 | 8,766 | 3,510 |
| Laths | 1,781 | 917 | 2,006 | 4,237 | 1,189 |
| Grain | 16,215 | 11,231 | 10,690 | 9,832 | 10,895 |
| Clay and sand | 1,501 | 797 | | | 238 |
| Miscellaneous | 7,076 | 3,524 | 107 | 897 | 824 |
| Total | 126,854 | 93,632 | 91,264 | 118,022 | 103,654 |

*Shipments by lake.*

[Net tons.]

| Articles. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|
| Coal | 477,120 | 425,641 | 473,713 | 213,306 | 629,870 |
| Merchandise | | | 75 | 2,681 | 210 |
| Total | 477,120 | 425,641 | 473,788 | 215,987 | 630,080 |

About 10,000 passengers arrive and depart by water annually.

## R R 7.

## IMPROVEMENT OF HARBOR AT CAPE VINCENT, NEW YORK.

### REPORT OF OPERATIONS.

Under the contract in force the Buffalo Dredging Company, on June 9, 1903, began excavating the trench for the foundation of the breakwater extension 300 feet long and completed it on June 11, 1903.

The placing of foundation stone in the trench began June 15, and was in progress at the beginning of the fiscal year. No other work had been done.

The placing of foundation stone was continued during July and to August 20, when the foundation was completed, except final leveling for cribs, 3,898 cubic yards of stone having been placed.

Timber was received in August and the construction of cribs for the substructure of the timber-crib-concrete structure to be built was begun August 24, and continued until the three cribs, each 100 feet long, 27 feet wide, and 20 feet high, were completed in November.

The first crib of the extension was sunk in place October 3, 1903, but, owing to bad weather and delays in obtaining stone for leveling foundations and filling cribs, no more cribs were sunk in place in 1903.

The placing of foundation stone was completed in November, 1903, the total amount of stone placed being 4,892.11 cubic yards.

During November and December, to the close of operations on December 16, the contractors were engaged in repairing crib No. 1, sunk in place, and damaged twice by vessels striking it. Damaged timbers at the easterly end of the crib were all replaced by new timbers and the damage there fully repaired, excepting placing a few bolts. The damage near the westerly end of the crib, consisting of a broken top timber and broken fender piece, could not be repaired owing to severe winter weather.

Operations were resumed May 10, 1904, and the repair of damage on crib No. 1 completed May 14.

The second crib was sunk in place June 9 and the third and last crib on June 29. The filling of the second and third cribs with stone was nearly completed at the close of the fiscal year, and preparations for making concrete blocks for the superstructure were in progress.

## PROPOSED OPERATIONS AND REMARKS.

This breakwater is designed not to protect an anchorage but for vessels to moor to and to protect vessels moored at the wharves at Cape Vincent, and letters from masters of vessels plying between Lake Ontario and the St. Lawrence River and from vessel owners testify to the value of that part of the breakwater now completed. From these letters, printed on page 3371 of report for 1901, and from observation, it would seem that the value of this breakwater to the shipping plying between Lake Ontario and the St. Lawrence River is established. The 410 feet built in 1900, while of much usefulness, is inadequate, and the speedy appropriation of funds to complete the construction of the breakwater to the full length authorized by the project is much to be desired.

The estimate for building this breakwater is $200,000. Of this amount $98,000 has been appropriated. It is recommended that the balance, $102,000, be appropriated by the next river and harbor act, so that the entire breakwater and the project may be completed.

Experience with the breakwater rendered advisable certain modifications of the structure. It is found that vessels moor to both sides of it, the preferred side depending upon the direction of the wind. This indicated the desirability of a symmetrical structure adapted to mooring on both sides, and such a structure was designed and 300 feet of extension is now being constructed in a permanent concrete form, under the contract in force. This extension will be completed in 1904.

It is believed that no further extension of the shore return is needed.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $48,377.85 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 11,588.02 |
| July 1, 1904, balance unexpended | 36,789.83 |
| July 1, 1904, amount covered by uncompleted contracts | 34,299.51 |
| Amount (estimated) required for completion of existing project | 102,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 102,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

---

### APPROPRIATIONS.

| | |
|---|---|
| June 3, 1896 | $25,000 |
| March 3, 1899 | 25,000 |
| June 13, 1902 | 48,000 |
| Total | 98,000 |

## CONTRACTS IN FORCE.

*Contract for extending breakwater at Cape Vincent, N. Y., dated March 28, 1903.*

Name of contractor: Buffalo Dredging Company.

Rates:

| | |
|---|---|
| Excavation for foundation, per cubic yard | $0.75 |
| Foundation stone, per cubic yard | 1.60 |
| Timber cribs, per linear foot | 70.60 |
| Stone in superstructure, per cubic yard | 1.40 |
| Concrete blocks, per cubic yard | 11.50 |
| Concrete in place, per cubic yard | 9.00 |
| Manhole covers, each | 5.00 |
| Mooring posts, each | 10.00 |
| White-oak fender, per linear foot | 1.00 |

Date of approval: April 7, 1903.
Date of commencement: May 10, 1903.
Date of completion: December 1, 1903.
Time limit waived.

## COMMERCIAL STATISTICS OF CAPE VINCENT HARBOR, NEW YORK.

*Arrivals and departure of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 61 | 9,726 | 238 | 37,522 | 72 | 14,028 | 233 | 33,427 |
| Sail and barges | | | 122 | 6,391 | | | 129 | 5,977 |
| Total | 61 | 9,726 | 360 | 43,913 | 72 | 14,028 | 362 | 39,404 |

| | |
|---|---|
| Total arrivals and departures (tonnage, 107,071) | 855 |
| Increase of tonnage, 1903 over 1902 ... tons | 61,269 |
| Amount of revenue collected, year ending December 31, 1903 | $43,976.27 |
| Value of imports, year ending December 31, 1903 | $244,476.68 |
| Value of exports, year ending December 31, 1903 | $158,256.00 |
| Greatest draft of vessels (at breakwater, 16 feet) ... feet | 9 |
| Enrolled tonnage, port of Cape Vincent, N. Y. ... gross tons | 5,502 |

*Receipts by lake and river.*

[Net tons.]

| Articles. | 1899. | 1900. | 1901. | 1902. | 1903. |
|---|---|---|---|---|---|
| Lumber | 1,109 | 2,649 | 2,398 | 716 | 635 |
| Poles, ties, posts, and pulp wood | 391 | 2,655 | | 195 | 12,138 |
| Shingles | 218 | 527 | 730 | 948 | 275 |
| Lath | | | 50 | 155 | 25 |
| Fish | 205 | 382 | 438 | 580 | 699 |
| Stone | | 3,458 | | | |
| Coal | 482 | | 360 | | |
| Miscellaneous | 528 | 1,055 | 234 | 1,581 | 1,894 |
| Total | 2,933 | 10,721 | 4,209 | 4,175 | 15,666 |

Shipments by lake and river are: Jewelry, hardware, furs, chemicals, and other high-grade manufactured articles, to the value of about $125,000. No record of weight.

About 18,000 passengers arrive and depart by water annually.

## R R 8.

## IMPROVEMENT OF SHOALS IN THE ST. LAWRENCE RIVER BETWEEN OGDENSBURG, NEW YORK, AND THE FOOT OF LAKE ONTARIO.

### REPORT OF OPERATIONS.

No operations were carried on during the past fiscal year owing to lack of funds.

### PROPOSED OPERATIONS AND REMARKS.

All the shoals in American waters embraced in the project have been removed to the prescribed depth of 18 feet below the zero of the Oswego gauge (low water).

Shoals A, B, and C, also embraced in the project, are in Canadian waters. Application for permission to remove these shoals was made through the Department of State to the Canadian government, and on December 22, 1899, the necessary permission was granted.

No appropriation was made in the last river and harbor act for this work. If this project is to be completed there will be required $40,000, and I recommend that this amount be appropriated by the next river and harbor act.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $142.55 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 142.55 |
| Amount (estimated) required for completion of existing project | 40,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 40,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

### APPROPRIATIONS.

| | |
|---|---|
| September 19, 1890 | $5,000 |
| July 13, 1892 | 10,000 |
| August 18, 1894 | 8,000 |
| June 3, 1896 | 25,000 |
| March 3, 1899 | 20,000 |
| Total | 68,000 |

### COMMERCIAL STATISTICS.

The commerce involved and interested in this improvement includes that of all the ports of the St. Lawrence River from Lake Ontario to the sea.

## R R 9.

# IMPROVEMENT OF HARBOR AT OGDENSBURG, NEW YORK.

### REPORT OF OPERATIONS.

At the beginning of the fiscal year dredging was in progress in the channel in the mouth of the Oswegatchie River, under the contract in force. This channel was completed on July 13, 1903, and the contract closed. The amount of material dredged during the partial month was 2,971 cubic yards, scow measure, of hardpan, and 3,241 cubic yards, scow measure, of sand, mud, clay, etc. The channel in the mouth of the Oswegatchie River is now 15 feet deep at zero of Oswego gauge for the full width between docks (200 feet, narrowing to 100 feet at the bridge) from a line 30 feet below the highway bridge to the St. Lawrence River channel.

On the completion of the contract all of the channels of the harbor had been dredged to the depths required by the project, the total amounts excavated from the harbor channels being 21,950 cubic yards of hardpan and 51,016 cubic yards of soft material.

### PROPOSED OPERATIONS AND REMARKS.

This harbor fills up with sand and silt and requires frequent dredging to maintain the depth of the project.

It is estimated that there will be required to June 30, 1906, for dredging and office and engineering expenses, $20,000, and I recommend that this amount be appropriated.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $5,570.38 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 5,296.07 |
| July 1, 1904, balance unexpended | 274.31 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 20,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

### APPROPRIATIONS AND ALLOTMENTS.

| | |
|---|---|
| August 30, 1852 | $3,000.00 |
| March 2, 1867 | 40,000.00 |
| July 17, 1870 | 15,000.00 |
| March 3, 1871 | 25,000.00 |
| June 10, 1872 | 10,000.00 |
| March 3, 1873 | 6,000.00 |
| June 23, 1874 | 6,000.00 |
| March 3, 1875 | 5,000.00 |
| December 11, 1877 (from appropriation for "Repairs on harbors on northern lakes") | 5.56 |
| September 10, 1879 (from appropriation for "Examinations, surveys, and contingencies of rivers and harbors") | 300.00 |
| July 26, 1880 (from appropriations for "Examinations, surveys, and contingencies of rivers and harbors") | $50.00 |
| August 2, 1882 | 10,000.00 |
| July 3, 1884 | 15,000.00 |
| August 5, 1886 | 10,000.00 |
| August 11, 1888 | 15,000.00 |
| September 19, 1890 | 42,000.00 |
| July 13, 1892 | 40,000.00 |
| August 18, 1894 | 20,000.00 |
| June 3, 1896 | 20,000.00 |
| March 3, 1899 | 15,000.00 |
| June 13, 1902 | 20,000.00 |
| Total | 317,355.56 |

### COMMERCIAL STATISTICS FOR OGDENSBURG, N. Y.

*Arrivals and departures of vessels for the year ending December 31, 1903.*

| Vessels. | Arrivals from— | | | | Departures to— | | | |
|---|---|---|---|---|---|---|---|---|
| | Home ports. | | Foreign ports. | | Home ports. | | Foreign ports. | |
| | No. | Tons. | No. | Tons. | No. | Tons. | No. | Tons. |
| Steam | 671 | 282,324 | 837 | 70,655 | 700 | 295,263 | 730 | 52,734 |
| Sail and barges | 87 | 25,925 | 285 | 88,904 | 226 | 74,531 | 101 | 35,063 |
| Total | 758 | 308,249 | 1,122 | 159,559 | 926 | 369,794 | 831 | 87,797 |

| | |
|---|---|
| Total arrivals and departures (tonnage 925,399) | 3,637 |
| Increase of tonnage, 1903 over 1902 ....tons.. | 21,500 |
| Amount of revenue collected on water transportation, year ending December 31, 1903 | $294,266.89 |
| Value of imports by water, year ending December 31, 1903 | $17,251,981.00 |
| Value of exports by water, year ending December 31, 1903 | $4,543,346.00 |
| Greatest draft of vessels ....feet.. | 16 |
| Enrolled tonnage, port of Ogdensburg ....net tons.. | 21,099 |

*Receipts and shipments by water.*

[Net tons.]

| Articles. | 1902. | | 1903. | |
|---|---|---|---|---|
| | Receipts. | Shipments. | Receipts. | Shipments. |
| Coal, anthracite | 13,896 | .............. | 432,200 | .............. |
| Coal, bituminous | 243,731 | 118,475 | ............ | 110,086 |
| Wheat | 39,999 | 44,266 | 198,409 | 52,615 |
| Corn | 82,259 | | | |
| Oats | 8,844 | | | |
| Barley | 192 | | | |
| Lumber | 215,200 | ............ | 193,535 | .............. |
| Merchandise, etc | 68,717 | 1,446 | 109,375 | 89,655 |
| Total | 672,838 | 164,187 | 933,519 | 252,356 |

Record incomplete. There is a quantity of merchandise and lumber received and coal shipped by ferry across the St. Lawrence River to Prescott, Ontario, of which collector of customs at Ogdensburg furnished no record.

Foreign merchandise to the value of $20,000,000 is received and shipped by water and rail annually, passing through the custom-house at Ogdensburg. The relative amounts of this merchandise carried by vessels and railroads and its classification and tonnage can not be obtained from the custom-house records.

About 200,000 passengers arrive and depart by water annually.

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## R R 10.

## PRELIMINARY EXAMINATION AND SURVEY OF OLCOTT HARBOR, NEW YORK.

[Printed in House Doc. No. 282, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 7, 1903.*

Sir: I have the honor to submit herewith reports dated January 12 and April 14, 1903, by Maj. T. W. Symons, Corps of Engineers, on preliminary examination and survey, respectively, of Olcott Harbor, New York, authorized by the river and harbor act approved June 13, 1902.

In the opinion of Colonel Symons, concurred in by the division engineer, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, U. S. Army, retired), the future prospects of the town are such as to justify the improvement of the harbor to a reasonable degree and its maintenance by the General Government. He presents in his report on survey a plan for improvement by pier extension and excavation with a view to securing an entrance channel 200 feet wide and 15 feet deep at low water at an estimated cost, in round numbers, of $60,000.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors in accordance with the provisions of sections 3 and 14 of the above-mentioned act; the locality has been visited and a public hearing has been held at which interested parties were given full opportunity to express their views. Attention is invited to the Board's report in seventh indorsement thereon, in which is given a résumé of the work heretofore done and now in progress for the improvement of this harbor. After careful consideration of the facts before it the Board concludes that it is not advisable for the United States at the present time to undertake any work in extension of this improvement, and I concur in this opinion.

The Board and the district officer have given consideration also to plans for a low concrete steel capping upon the substructure of the existing piers, with a view to preserving them from destruction until such time as changed commercial conditions may again demand harbor facilities in this locality, but the cost of such work was found to be in excess of prospective benefits to commerce.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF OLCOTT HARBOR, NEW YORK.

United States Engineer Office,
*Buffalo, N. Y., January 12, 1903.*

General: I have the honor to submit the following report on the preliminary examination of Olcott Harbor, New York.

Olcott Harbor is on Lake Ontario at the mouth of Eighteen-mile Creek, 18 miles east of the mouth of the Niagara River. It has been under improvement by the United States since 1867, when the first appropriation for it was made. The original project for the improvement adopted in 1866 proposed to connect deep water in Lake Ontario with deep water in Eighteen-mile Creek by the extension of two parallel piers from the mouth of the creek to the 11-foot curve in the lake, with the formation of a dredged channel between the piers. The project was modified in 1872 to provide for the removal of rock from the channel between the piers, and in 1881 to provide for additional pier extension.

Up to 1890 the Government had appropriated $163,000 for improvements at Olcott, and the port failed to develop any business worth

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*March 2, 1903.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Olcott Harbor, New York, authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors, in the preceding indorsement, I recommend that a plan and estimate of cost of further improvement of the locality, as proposed, be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,
*March 6, 1903.*

Approved as recommended by the the Chief of Engineers.

WM. CARY SANGER,
*Assistant Secretary of War.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 21, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with plan and estimate of cost of improvement as recommended.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 27, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the accompanying report of the district officer containing a project for improving Olcott Harbor and an estimate of cost, together with other data available. On May 26 a committee of the Board inspected the locality and held a public hearing at Olcott, at which interested parties were given full opportunity to express their views.

This harbor has been under improvement by the United States since 1867. In 1896, after about $163,000 had been expended and the existing project completed, the disproportion between the business done and the expense of maintaining the port was so great as to lead to the abandonment of the harbor as one to be maintained further by the United States. The depth between the piers at that time was 13.5 feet at mean lake level, or 10.5 at standard low water. There was only 10 feet at standard low water on the outer bar.

The river and harbor act of June 13, 1902, contained an appropriation of $15,000 for continuing the improvement of this harbor. The appropriation was not based upon any recommendation emanating from the War Department.

This money has been expended in excavating a channel 13½ feet deep at standard low water and 180 feet wide from the deep water just beyond the pierheads to the Main Street Bridge. The outer bar is still unimproved.

The present commerce of this port is nil. It was represented at the public hearing that there are strong prospects for a future commerce of considerable proportions; that the International Railway Company is operating a line from North Tonawanda to Lockport and from Lockport to Olcott, the same being an electric line, but of standard steam railroad construction and equipped with 35-ton electric locomotives; that this company has certain traffic agreements with the Erie Railroad and expects to ship coal in large quantities from Olcott to Canadian ports. Other arguments were advanced in favor of the proposed improvements, all based upon prospective developments.

The Erie Railroad, through connections, already utilizes Fairhaven Harbor as a coal-shipping point, and correspondence with the president of this road fails to elicit any information concerning plans for the shipment of coal from Olcott Harbor. The presence of an attractive summer hotel and other facts will, no doubt, bring about an extensive excursion business, but the information presented to the Board affords no basis for the expectation held by interested parties that a commerce will develop sufficient to warrant a large expenditure on the part of the United States for further immediate improvements at this place.

The present commerce of the New York shore of Lake Ontario is amply served by existing deep-water harbors in the Niagara River, and at Charlotte, Great Sodus, Fairhaven, and Oswego.

The work recommended by the district officer is to extend the piers 200 feet each, and to excavate a channel 200 feet wide and 15½ feet deep at standard low water to the same depth in the lake, at an estimated cost of $41,360 for pier extention and $18,920 for dredging; in all, $60,280.

The Board believes that it is not advisable for the United States at the present time to undertake this or any other work in extension of this improvement.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

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## SURVEY OF OLCOTT HARBOR, NEW YORK.

United States Engineer Office,
*Buffalo, N. Y., April 14, 1903.*

General: I have the honor to submit the following report on a survey and estimate of cost of the improvement of Olcott Harbor, New York, to comply with your letter of March 10, 1903, which directs me to make "a definite recommendation as to the extent of improvement justified by the commercial intersts, present and prospective, involved," and also to include "any additional facts or arguments that may be deemed essential to permit of a full and complete consideration of the merits of this case, both by the Department and by Congress."

There is submitted herewith a tracing[a] of Olcott Harbor, showing its condition as determined by the survey made in conformity with your letter of March 10, 1903, and also showing the improvements deemed advisable and justified by the commercial interests involved, shown in red.

A brief history of Olcott Harbor is given in my report on a preliminary examination thereof, dated January 12, 1903. There is also given in that report what may be considered a full statement of the facts and arguments necessary for a consideration of the merits of the improvements proposed and estimated for herein. These proposed improvements are in extension of those provided for under the existing project and if carried out will, it is believed, in connection with the maintenance of the harbor as it exists under the existing project, meet the requirements of the commerce quite certain to be developed by the railroad interests which have recently undertaken such developments.

The harbor would be confined to the portion of the Eighteen-mile Creek lakeward from the Main Street Bridge, which is a fixed structure. The portion from the bridge to the end of the piers has been improved by the building of piers and excavation of a channel between them under the existing project. The piers are in fair condition and the channel between them is now being dredged from the bridge to the end of the piers, with funds provided by the river and harbor act of June 13, 1902. This dredging will be completed before July 1, 1903, and will secure a channel 13¼ feet deep at extreme low water, or 14.2 feet deep at standard low water, as indicated by the zero of the Olcott gauge, or 16.6 feet deep at mean level of Lake Ontario. This channel will be adequate for the present commerce and the prospective commerce which is expected to develop, and which must necessarily be limited to the size of vessels which can pass through the Welland and St. Lawrence canals, viz, vessels of 14 feet draft.

There will not be, however, an approach channel in the lake outside of the pierheads commensurate with the channel between the piers. Such an approach channel is needed, and the proposed improvements are therefore planned and estimated for with a view to securing it. These improvements should consist of an extension to each of the piers of 200 feet lakeward and the excavation of a channel out to deep water in the lake.

The lake bottom outside of the present piers is shale rock covered with a thin layer of sand. The rock is about 10 to 12 feet below low water at the end of the piers, and from these ends it dips rapidly lakeward for about 200 feet, where it reaches a depth of about 20 feet at low water. The rock then rises rapidly, forming a ridge across the entrance to the harbor, with a depth of only 10 feet at low water on the bare rock about 500 feet outside of the piers. Thence the rock dips gradually until deep water is reached, 900 to 1,000 feet beyond the piers.

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[a] Not printed.

With the two piers extended 200 feet each and a channel excavated 15 feet deep at standard low-water level through the rock ledge and beyond to the natural contour of 15 feet depth at standard low water, it is believed that Olcott Harbor would be adequate for a considerable commerce by vessels of Welland Canal size, and the improvement to this extent is therefore recommended. The channel 15 feet deep at low water would insure about 1 foot of water under the keels of vessels of the maximum draft of 14 feet at low water, which is of comparatively rare occurrence, and 2 or more feet under the keels of vessels under ordinary conditions.

The estimated cost of the proposed improvements is as follows:

### PIER EXTENSIONS.

| | | |
|---|---|---|
| West pier: | | |
| 100 linear feet of crib substructure, 10 feet high to low-water level, at $36 per linear foot | | $3,600 |
| 100 linear feet of crib substructure, 16 to 20 feet high to low-water level, at $60 per linear foot | | 6,000 |
| Preparing rock foundation, 200 linear feet, at $10 | | 2,000 |
| 200 linear feet of concrete superstructure, 7 feet high above low-water level, at $35 per linear foot | | 7,000 |
| Total for west pier | | 18,600 |
| East pier: | | |
| 100 linear feet of crib substructure, 12 feet high to low-water level, at $40 per linear foot | $4,000 | |
| 100 linear feet of crib substructure, 16 to 20 feet high to low-water level, at $60 per linear foot | 6,000 | |
| Preparing rock foundation, 200 linear feet, at $10 | 2,000 | |
| 200 linear feet of concrete superstructure, 7 feet high above low-water level, at $35 per linear foot | 7,000 | |
| Total for east pier | | 19,000 |
| Total for pier extensions | | 37,600 |

### APPROACH CHANNEL.

| | |
|---|---|
| From outer end of present piers to the 15-foot contour, at low water, in the lake, distance 900 feet, channel to be 200 feet wide and 15 feet deep at low-water level, as shown by the zero of Olcott gauge—zero Oswego gauge: | |
| Dredging 1,000 cubic yards, place measure, of sand and clay overlying rock, at 20 cents per cubic yard | $200 |
| Excavating 6,000 cubic yards, place measure, of shale rock, requiring drilling and blasting, at $2.50 per cubic yard | 15,000 |
| Excavating 4,000 cubic yards, place measure, of shale rock, by dredging only, at 50 cents per cubic yard | 2,000 |
| Total | 17,200 |

SUMMARY.

| | |
|---|---|
| Pier extensions | $3 |
| Approach channel | 1 |
| Total | 5 |
| Contingencies, engineering, etc., 10 per cent | |
| Grand total | 6 |

In round numbers, $60,000.

There is submitted herewith a letter from Mr. W. Caryl Ely, p dent of the International Railway Company, bearing upon the m of improving Olcott Harbor, to which attention is respectfully inv

Very respectfully, your obedient servant,

T. W. SYMONS,
*Major, Corps of Enginee*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

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LETTER OF THE INTERNATIONAL RAILWAY COMPANY.

INTERNATIONAL RAILWAY COMPANY,
*Buffalo, N. Y., April 13, 19*

MY DEAR SIR: With reference to the improvement of the harbor at Olcott an present and future commercial developments and projects upon which the same be said to depend, I beg to state the primary factor is the line of the Internat Railway Company, running to this port and connecting the same with the cit Lockport, Niagara Falls, North Tonawanda, Tonawanda, and Buffalo. This rai is entirely upon private right of way, partly leased from the Erie Railroad Com under 999-year lease, and partly acquired by private purchase. It is all stan steam railroad construction, completed in 1901; 85-pound T rails, in 60-foot len stone ballast, white-oak ties, and ample equipment of passenger and freight cars is part of a system of 352 miles of road, mostly street surface. Constituting a p the railway terminals is a large pleasure park, containing a large and very fine and all the accessories of a pleasure resort, which is and will be continued a finest place of the kind upon the lakes in the vicinity of Buffalo and Toronto. attracting and will attract great crowds of excursionists. The railway company in the vicinity about 100 acres of land, and will acquire all that is necessary to de freight and passenger terminals at and in connection with the harbor and park.

In connection with the lease from the Erie Railroad, hereinbefore referred to International Railway Company has an agreement practically making the line bet Buffalo and Olcott a component part of the Erie system in so far as freight bus is concerned. Under the terms of the agreement the Erie supplies all nece equipment for the transaction of freight business, such as coal, refrigerator, and fr cars, etc.

To make this communication brief, I will summarize as follows:

The port of Olcott is reached by a first-class line of railroad, thoroughly equi for passenger and freight service.

The railroad line being connected with street-surface railroad lines in the citi Buffalo, Tonawanda, North Tonawanda, Niagara Falls, and Lockport, poss facilities for bringing to Olcott large numbers of people.

Olcott is the natural lake port for Lockport, a city of large industries, which be largely increased in the near future, on account of increased water power, w will be available after the enlargement of the Erie Canal.

We are now contracting to bring into the port of Olcott from 15,000 to 30,000 of pulp wood per annum for Lockport paper mills.

It is the natural gateway of the Erie Railroad for the shipment of coal to To and other Canadian ports. The possible tonnage from this source is stated b vice-president of the Erie Railroad Company to be from 60,000 to 80,000 tons per annum. The east shore of the harbor is admirably adapted for the establishment of coal-handling devices.

As a stopping place for St. Lawrence River steamers it would become the natural port of embarkation of passengers from Buffalo, Niagara Falls, and vicinity. It is now necessary to go to Rochester and Charlotte at great inconvenience as compared with the shorter and direct route via Olcott. A substantial reduction in the passenger tariff from these points would also be effected.

It would afford a fine and convenient harbor for Lake Ontario yachtsmen.

It is intended to provide a regular line of steamers to ply between Toronto and Olcott, similar to the Niagara River line which now plies between Toronto and Lewiston. This would constitute a new line of travel between Toronto and Buffalo, Niagara Falls, and vicinity.

It is possible that connection may be made with a line of Canadian railway at or near Toronto by means of a car ferry. This of itself would insure a very large tonnage for the port.

The International Railway Company has gross earnings of upward of $3,500,000 per annum, which are rapidly increasing, and the port of Olcott has surrounding it within a radius of 50 miles a population of nearly 1,000,000. The railway company is controlled by one of the strongest financial interests in this country, and is amply able to do everything that is necessary to develop railway and boat lines in connection with the port.

In view of all the facts, I would make the following suggestions:

(a) That the existing piers be extended.

(b) That the harbor be given a depth of 16 feet, and the same connected with the deep waters of the lake by a channel of like depth.

(c) That the line of harbor improvement be made as broad as is possible under the rules and customs obtaining in your Department.

In conclusion, I am firmly of the opinion that the greatest development which you may feel like recommending will in the near future be found insufficient for the actual needs of the business of the port.

Yours, very truly,

W. CARYL ELY, *President.*

Maj. THOMAS W. SYMONS,
*Corps of Engineers, U. S. A.*

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## R R 11.

## PRELIMINARY EXAMINATION OF OSWEGO HARBOR, NEW YORK, WITH A VIEW TO ASCERTAINING THE COST OF NECESSARY REPAIRS TO THE OUTER BREAKWATER.

[Printed in House Doc. No. 55, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith reports dated February 3 and April 9, 1903, by Maj. Thomas W. Symons, Corps of Engineers, and report supplemental thereto dated August 31, 1903, with map,[a] by his successor, Maj. Theodore A. Bingham, Corps of Engineers, on preliminary examination of Oswego Harbor, New York, with a view to ascertaining the cost of necessary repairs to the outer breakwater, made pursuant to a requirement in the river and harbor act of June 13, 1902.

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[a] Not reprinted; printed in House Doc. No. 55, Fifty-eighth Congress, second session.

In the opinion of Major Symons, concurred in by the division engineer, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, U. S. Army, retired), the breakwater at Oswego should be repaired by protecting it with a riprap apron of heavy stone, and the present superstructure should be replaced by a superstructure of concrete or stone. A detailed project for making such repairs is presented in the report of Major Bingham, who estimates the cost in round numbers at $900,000.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors in accordance with the provisions of sections 3 and 14 of the above-named act, and attention is invited to its reports on the subject, dated June 6 and September 14, 1903. In the opinion of the Board the expense of the necessary repairs to the outer breakwater at Oswego as estimated by the district officer is justified by the commercial importance of this harbor, and it is desirable for the United States to undertake the improvement.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF MAJ. T. W. SYMONS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., February 3, 1903.*

GENERAL: I have the honor to submit the following report on the preliminary examination of "Oswego Harbor, with a view to ascertaining the cost of necessary repairs to the outer breakwater."

Oswego was formerly an important commercial city, having a large amount of water-borne commerce by lake and canal. The business of the port was so large and promising that the Government, in addition to a great deal of other work, felt justified in building a long and expensive breakwater for inclosing the outer harbor. In all, since 1826, there has been appropriated for harbor improvements $2,023,612.87 at this port of Oswego.

The outer breakwater was constructed during the period between 1870 and 1882, and was one of the first structures of the kind to be built on the lakes. Unfortunately in designing it the very severe wave action of the locality was not fully appreciated, and the cribs of which it is composed were not built of sufficient strength, and it has in consequence been seriously injured several times and has been altogether an expensive structure to maintain. The condition of the breakwater is such as to necessitate continual and expensive repairs and to cause grave doubts as to its stability and fear of its general collapse in the event of a particularly violent storm.

This breakwater is composed of a series of stone-filled timber cribs 35 feet square, placed in juxtaposition and surmounted by a continuous timber superstructure, the parapet of which extends to about 13 feet above low water and the banquette to about 5 feet above low water, except a part of the west shore arm, which is only 9 feet high. The total length of the breakwater is 6,032 feet, as follows:

| | Feet. |
|---|---|
| Channel arm | 246 |
| Main breakwater | 4,707 |
| West shore arm | 916 |
| Breach of 1884 | 163 |
| | 6,032 |

The existing project provides for maintaining an opening of 75 feet in the 1884 breach for water circulation. The length of breakwater, the treatment of which must therefore be considered, is:

| | Feet. |
|---|---|
| Main breakwater and west shore arm | 5,711 |
| Channel arm | 246 |
| | 5,957 |

Experience shows that the breakwater as it stands is not of sufficient strength and stability to fully withstand the forces tending to destroy it. The records show that it has been breached five times, the breach of 1884 yet remaining open.

The first systematic examination and repair of the substructure of the outer breakwater was made in 1897. This examination, besides showing several small breaches in the lake face, also showed a tendency of the lake face wall of the cribs to fall out. Five cribs were repaired in 1897 by placing timbers in the corners and drawing in the wall with screw bolts.

The examination made in 1898 showed a large number of cribs with the walls drawn from 1 inch to 8 inches and four which were drawn from 10 inches to 24 inches. The latter were repaired. The crib which was drawn 23 inches was shown by the examination of the previous year to have been then drawn but 12½ inches, showing progressive action.

Another thing shown by these examinations is that the largest amount of draw is located from 6 feet to 8 feet below the water surface, which would seem to indicate this depth as the location of the greatest force, due to the receding of the waves. The work of putting corner posts in the cribs and drawing in and fastening the walls thereto has been going on ever since.

During several past seasons repairs were necessary at different places where the outer walls of the cribwork below water had become partially displaced, seriously threatening the integrity of the structure. These repairs were made by placing vertical posts in the cribs from a depth of about 20 feet to above water level and securing the crib timber walls to these posts with screw bolts.

Repairs of this nature require the removal of stone filling to the depth of about 20 feet, which necessarily implies the employment of divers, and as the subsequent placing and bolting of the vertical posts must also necessarily be done by the divers the repair work is extremely costly.

From the annual reports of the officer in charge it appears that the cost of maintaining the outer and inner breakwaters from 1881, when construction ceased, to June 30, 1897, was $386,769.16, by far the larger proportion of which is chargeable against the outer breakwater.

The following table, compiled from the records in this office, shows the cost of maintenance and repairs to the outer breakwater from July 1, 1882, to June 30, 1902:

| Fiscal year: | | Fiscal year: | |
|---|---|---|---|
| 1883 | $13,000.00 | 1895 | $11,200.00 |
| 1884 | 23,633.52 | 1896 | 8,462.80 |
| 1885 | 63,029.83 | 1897 | 20,220.57 |
| 1886 (funds exhausted) | 1,568.09 | 1898 | 8,458.29 |
| 1887 | 6,356.68 | 1899 | 8,869.17 |
| 1888 | 31,899.75 | 1900 | 17,984.08 |
| 1889 | 7,057.54 | 1901 | 15,998.95 |
| 1890 | 6,848.29 | 1902 | 5,699.11 |
| 1891 | 56,595.51 | | |
| 1892 | 12,802.85 | | 326,779.11 |
| 1893 | 3,410.19 | Average cost per year for twenty years | 16,338.95 |
| 1894 | 3,683.89 | | |

It seems probable that the necessity for this repair work will increase in the future. The cause of the trouble may be stated as follows:

The Oswego breakwater is exposed to extremely severe wave force during the northwesterly storms, which have a reach of the entire length of Lake Ontario. About 25 per cent of the storms on this lake are from the northwest, and create a wave force at Oswego probably greater than at any other lake port. Physical conditions, therefore, demand unusual strength and weight in breakwater construction. That the timber-crib structure at Oswego does not possess the required strength and stability is evident. This arises from the facts:

First. That the structure is deficient in dead weight, this being shown by its trembling under the impact of moderately strong waves.

Second. The superstructure, 8 feet high and 12 feet wide, is deficient in weight and strength to withstand the enormous wave force to which it is subjected, except where the structure is comparatively new. On a portion of the structure braces have had to be placed from the banquette to the back wall of the parapet to prop up the parapet.

Third. The substructure is defective in construction in that the cribs are not fully bolted, the crib corners and cross ties having no bolts and no hold except that resulting from dovetail framing, and wherever this framing has become loosened, due to repeated shocks and to wear and scour in the joints, the crib walls—outer walls especially—have not the strength to resist the wave force, which tends to pull them out of place lakeward. If not discovered and checked in time, this dislodgment increases until the crib walls finally break outward and a breach results. After the substructure is thus breached and the stone filling washed out, destruction of the superstructure is almost inevitable.

There have, however, been instances of the superstructure being destroyed over sound cribs. This is caused, no doubt, by the extreme wave force acting upon the superstructure somewhat weakened by age and which is not strong enough as built to resist the excessive strain to which it is subjected. This shows that the superstructure is not of sufficient weight to stand practically rigid when subjected to the impact of large waves, and as a result the fastenings are gradually loosened and finally yield. The yielding is aggravated by the deck being first troyed and the stone filling thrown out by the waves.

medy existing defects and place the breakwater in a thoroughly d satisfactory condition will require the substructure to be d by a riprapping of heavy stone and a new superstructure of concrete or stone built in place of the existing weak and decaying superstructure.

This work will require a large sum of money, not very far either way from $1,000,000, and the consideration of the amount of Oswego's commerce and the other interests involved render it somewhat questionable whether this large expenditure can properly be regarded as justifiable.

Oswego's commerce is small in amount, and has for many years been declining, and there is no apparent reason for hoping that it will greatly increase unless there is some marked change in existing conditions.

The following table shows the amount and gradual diminution of Oswego's commerce:

| Fiscal year ending June 30— | Total arrivals and departures (number vessels). | Registered tonnage. | Total receipts and shipments. | Receipts by lake. | Shipments by lake. |
|---|---|---|---|---|---|
| | | *Tons.* | *Net tons.* | *Net tons.* | *Net tons.* |
| 1870 | 10,327 | 1,693,486 | | | |
| 1871 | 10,306 | 1,602,521 | | | |
| 1874 | 6,611 | 1,124,761 | | | |
| 1875 | 5,084 | 893,119 | | | |
| 1876 | 4,685 | 709,392 | | | |
| 1877 | 4,259 | 780,931 | | | |
| 1878 | 4,614 | 826,630 | | | |
| 1879 | 4,239 | 714,639 | | | |
| 1880 | 4,749 | 807,370 | | | |
| 1881 | 4,993 | 805,948 | | | |
| 1882 | 5,399 | 902,708 | | | |
| 1883 | 5,032 | 898,519 | | | |
| 1883 [a] | 4,288 | 699,126 | | | |
| 1884 [a] | 4,279 | 868,367 | | | |
| 1885 [a] | 3,646 | 700,401 | | | |
| 1887 | 3,595 | 680,360 | | | |
| 1888 | 4,792 | 885,669 | | | |
| 1889 | 5,099 | 933,754 | | | |
| 1890 | 3,799 | 717,391 | | | |
| 1891 | 6,086 | 1,071,504 | 1,094,945 | 384,457 | 710,488 |
| 1892 | 5,566 | 1,030,380 | 826,816 | 285,674 | 541,142 |
| 1893 | 5,381 | 1,072,267 | 964,240 | 337,587 | 626,653 |
| 1894 | 5,499 | 1,088,625 | 917,688 | 237,168 | 710,520 |
| 1895 | 4,308 | 957,009 | 829,469 | 199,356 | 630,113 |
| 1895 [a] | 3,566 | 815,793 | 749,575 | | |
| 1896 [a] | 3,279 | 882,018 | 783,972 | | |
| 1897 [a] | 3,038 | 787,876 | 706,805 | | |
| 1898 [a] | 2,644 | 743,807 | 615,508 | | |
| 1899 [a] | 2,834 | 708,936 | 603,974 | 126,854 | 477,120 |
| 1900 [a] | 2,606 | 564,110 | 518,673 | 93,032 | 425,641 |
| 1901 [a] | 2,371 | 514,285 | 565,052 | 91,264 | 473,788 |
| 1902 [a] | 1,383 | 300,301 | 241,102 | 25,215 | 215,887 |

[a] Calendar year.

The low record for 1902 is largely due to the great coal strike cutting off the coal supply which is ordinarily shipped from Oswego. The receipts at the port are principally lumber and grain and the shipments almost exclusively coal.

Besides its value as an ordinary commercial harbor, the outer harbor at Oswego has a certain value as a harbor of refuge. It is the most easterly harbor on the south coast of Lake Ontario, and as most of the exceedingly severe storms on the lake come from the northwest, vessels in distress running between the St. Lawrence and our other Ontario ports find it easy and convenient to run before the storm and make Oswego Harbor and lie in behind the breakwater until the weather settles. If the outer breakwater were destroyed, these vessels would still find shelter in the inner harbor and river, although not to the extent or as conveniently as in the outer harbor.

This breakwater may be treated in several different ways.

(*a*) It may be put in a thoroughly good condition by riprapping its front and supplying a new superstructure. This will cost something like $1,000,000 and would be the most satisfactory solution of the problem and the one which I would recommend be adopted if it is deemed that the commercial condition and prospects of Oswego and its use as a harbor of refuge justify it.

(*b*) The present method of repairs may be continued and the structure, as it generally exists to-day, be made to last as long as practicable. To put corner posts in all of the cribs where they are now apparently needed and repair the whole structure in accordance with the existing practice will cost from $60,000 to $100,000, and the work could be extended over a number of years. In this case the superstructure would in addition require constant and extensive repairs. It is not believed that it would be proper and justifiable to put a new and expensive superstructure on the old existing substructure, simply improved, as outlined, with corner posts.

(*c*) In case the latter method should be adopted the breakwater might be made to last several years longer, barring abnormal storms, during which the development of Oswego's commerce might indicate more clearly the course to pursue with regard to the breakwater. If the commerce justified, it might then be improved at the large cost of about $1,000,000. If the commerce did not increase but continued to decrease to the extent that it could be well and amply provided for in the inner harbor and river, the idea of abandoning the outer breakwater to its fate might be worthy of consideration.

(*d*) It is to be noted that in the outer harbor there is one important commercial industry and two of minor importance. The important industry is a coal trestle of the Delaware, Lackawanna and Western Railroad, from which in 1901 329,192 net tons of anthracite coal were shipped. At the western end of the outer harbor is the wharf of the Standard Oil Company, where timber is received and made into box shooks. In 1901 this amounted to 22,760 net tons. Also at the western end is the wharf of the Diamond Match Company, where lumber is received to be made into matches. The amount so received in 1901 was 5,063 net tons.

(*e*) It is also worthy of note in this connection that the State of New York is now considering the enlargement of the Erie and Oswego canals to a size suitable for barges of 1,000 tons with locks, taking two such barges at a lockage. The measure appropriating $82,000,000 for this work is now up in the State legislature and if it is finally passed and ratified by the people it may, when carried out, make a very considerable difference in Oswego's water-borne commerce, greatly increasing it and justifying the thorough repair or rebuilding of the breakwater at the cost of about $1,000,000.

After giving the matter full and careful consideration I beg to state that in my opinion the breakwater at Oswego should be repaired by protecting it with a riprap apron of heavy stone and that the present superstructure should be replaced with a superstructure of concrete or stone at a cost of about $1,000,000, provided that the present and prospective commerce of Oswego, and its use as a harbor of refuge, be deemed to justify this expenditure.

If this expenditure be not deemed justifiable then I recommend that the present method of repairs, by placing corner posts in the cribs and drawing and bolting the walls thereto and keeping the superstructure in place by bracing and other repairs, be continued for the present.

No special allotment of funds will be required to make any plans or estimates that may be ordered or found necessary in connection with this work.

Very respectfully, your obedient servant,

T. W. Symons,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. Engineer Office, Eastern Division,
*New York City, February 6, 1903.*

Respectfully forwarded to the Chief of Engineers, U. S. Army, concurring in the views and recommendations of the district officer.

S. M. Mansfield,
*Colonel, Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

Office Chief of Engineers, U. S. Army,
*February 11, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brigadier-General Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Third indorsement.]

Board of Engineers for Rivers and Harbors,
*Washington, D. C., June 6, 1903.*

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has carefully considered the within report of the district officer, the indorsement of the division engineer thereon, and all other data available. On May 28, 1903, a committee of the Board inspected the harbor and breakwater, and held a public hearing in the city of Oswego, at which interested persons appeared and presented arguments and data bearing upon the necessity of the improvement contemplated.

The outer breakwater was built of rock-filled timber cribs and superstructure in the period between 1870 and 1882, and was one of the first of its kind upon the Great Lakes. It is now in a weakened condition throughout, and the superstructure is badly decayed. For a number of years the annual cost of maintenance has averaged over $16,000. The repairs have necessarily been of a temporary character and have not kept pace with the general deterioration of the structure.

It is the desire of the community of Oswego, and of shippers using that port, that extensive repairs of a permanent character be now undertaken by the General Government. The district officer expresses the opinion that the best solution of the problem is that of permanent repair, even at great cost, provided the present and prospective commerce, and the use of the port as a harbor of refuge, are thought to be of sufficient importance to justify the expenditure. He estimates that the necessary repairs will cost approximately $1,000,000.

The tonnage of the port has materially decreased since 1894. Nevertheless, in 1901 the total movement, inbound and out, was 565,052 tons. The abnormally low figures for 1902 (241,102 tons) may fairly be attributed to the coal strike. According to present indications the commerce for 1903 will equal, if not exceed, that for 1901, and there is reason to believe that it will at least be sustained in the future. Oswego is an important terminal harbor for the New York Central, Ontario and Western, and Delaware, Lackawanna and Western railways. It is upon a branch of the Erie Canal, the deepening of which to 12 feet is now under consideration by the people of the State of New York. The abrogation of tolls upon the Welland Canal, in the early part of this year, appears to add materially to the prospective commerce of Oswego.

Considered as a harbor of refuge alone, the breakwater harbor at Oswego is worthy of preservation. It is near the paths of vessels passing between the St. Lawrence River and all ports on the south shore of Lake Ontario west of and including Great Sodus. Furthermore, the breakwater at Oswego would form the most suitable harbor of refuge for American shipping on Lake Ontario in time of war upon the northern frontier. The desirability of such a harbor has received much consideration in connection with general projects for national defense.

For the reasons stated above, the Board is of the opinion that Oswego Harbor is worthy of improvement to the extent of the permanent repair of the outer breakwater, provided the cost does not materially exceed the approximate estimate of $1,000,000, and recommends that the district officer be directed to prepare detailed estimates of cost.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

Office Chief of Engineers, U. S. Army,
*June 17, 1903.*

Respectfully referred to Maj. Theodore A. Bingham, Corps of Engineers.

The views of the Board of Engineers for Rivers and Harbors are concurred in by the Chief of Engineers, and Major Bingham is requested to prepare and submit the detailed estimates of cost as indicated in the preceding indorsement.

* * * * * * *

By command of Brig. Gen. Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Fifth indorsement.]

U. S. ENGINEER OFFICE,
*Buffalo, N. Y., August 31, 1903.*

Respectfully returned to the Chief of Engineers, through division engineer, eastern division, with letter of this date giving detailed estimate of cost.

THEO. A. BINGHAM,
*Major, Corps of Engineers.*

[Sixth indorsement.]

U. S. ENGINEER OFFICE, EASTERN DIVISION,
*New York City, September 4, 1903.*

Respectfully forwarded to the Chief of Engineers, U. S. Army.

The estimates appear to be ample, except perhaps for the item of capping stone. The cost of material and labor in placing these, some of which are in water 18 feet or more in depth, is estimated at $1.75 per ton, which is about $1 per square foot of top area. This estimate may be based upon actual cost of similar work under similar circumstances, and therefore known to be approximately correct. The amount for contingencies and engineering is not too large.

AMOS STICKNEY,
*Colonel, Corps of Engineers,*
*Division Engineer.*

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*September 8, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors, with report containing detailed estimates of cost of repairs to breakwater.

By command of Brigadier-General Gillespie:

H. F. HODGES,
*Major, Corps of Engineers.*

[Eighth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., September 14, 1903.*

Respectfully returned to the Chief of Engineers, U. S. Army.

The detailed estimate of the district officer contained in his report of August 31, 1903, aggregates $900,000. Referring to paragraph 7 of the Board's report of June 6, 1903 (third indorsement hereon), the Board is of opinion that the expense of the "necessary repairs to the outer breakwater" at Oswego, as estimated by the district officer, is justified by the commercial importance of this harbor, and that it is desirable for the United States to undertake the improvement.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## LETTER OF MAJ. T. W. SYMONS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., April 9, 1903.*

GENERAL: Under date of February 3, 1903, I submitted a report on the preliminary examination of Oswego Harbor, New York. Paragraph 20 of this report contains a reference to the value of the outer harbor at Oswego as a harbor of refuge.

It has been represented to me that in this paragraph I did not do full justice to this feature of the harbor, and the Oswego Board of Trade has written me a letter,[a] dated April 8, 1903, bearing on the subject, and sent me fourteen letters[a] from vessel captains and owners, and persons familiar with the situation.

From the statements and data submitted, and from further consideration, it would appear that Oswego Harbor plays a very important part as a harbor of refuge, and that this feature should be given full consideration in finally deciding as to the course to be pursued in regard to the breakwater. The letter of the Oswego Board of Trade and the fourteen letters accompanying it are respectfully submitted herewith.

The geographical situation of Oswego Harbor is such as to make it valuable as a harbor of refuge, and the outer breakwater makes it very much more valuable for such use than if this breakwater did not exist. The loss or abandonment of this breakwater would undoubtedly be severely felt, especially by those engaged in the coal business on Lake Ontario, whether this business were done from Oswego or the other coal ports of Little Sodus, Great Sodus, or Charlotte.

It is respectfully recommended that this letter * * * be added to my report of February 3, 1903, as appendixes.

Very respectfully, your obedient servant,

T. W. SYMONS,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

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## DETAILED ESTIMATE OF COST OF THE PERMANENT REPAIR OF THE OUTER BREAKWATER, OSWEGO HARBOR, NEW YORK.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., August 31, 1903.*

GENERAL: I have the honor to submit the following report on "detailed estimates of cost of the permanent repair" of the outer breakwater, Oswego Harbor, New York, in conformity with the fourth indorsement on the report of Maj. T. W. Symons, Corps of Engineers, U. S. Army, dated February 3, 1903, on a preliminary examination of "Oswego Harbor, with a view to ascertaining the cost of necessary repairs to the outer breakwater."

The object sought is to repair and rebuild the present breakwater structure so as to place it in a permanent form practically secure from injury by the excessive wave force prevalent at the locality. The matter is fully discussed and explained in the report on the preliminary examination above referred to and need not be further discussed herein.

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[a] Not printed.

For many years past the problem of the permanent repair of the Oswego breakwater has been studied and many plans have been devised and estimates made for placing the structure in a secure condition.

A discussion and résumé of these plans and estimates of cost is given in the Annual Report of the Chief of Engineers for 1899, pages 3140–3143.

This report concludes as follows:

> The two methods of strengthening the substructure and the two varieties of superstructure can be combined in four ways, which, with estimate of cost, are as follows:

| | |
|---|---|
| (a) Heavy riprap protection for substructure and concrete superstructure. | $887,700 |
| (b) Substructure strengthened with vertical posts and concrete superstructure | 677,300 |
| (c) Heavy riprap protection for substructure and superstructure of creosoted pine | 676,300 |
| (d) Substructure strengthened with vertical posts and superstructure of creosoted pine | 465,000 |

Of these four plans, only the first can be considered as approaching the required and advisable condition of permanency of structure sought; and this first plan is not now considered adequate in the light of experience gained in the construction of the breakwater extension to Stony Point, at Buffalo Harbor, New York, where the wave force to contend with is as great, if not greater, than that mentioned at Oswego.

At Buffalo the rubble mound or stone type of breakwater has proved its superiority over any structure built with timber cribs for a substructure, surmounted by a superstructure of timber or concrete, and further, it has been proved that in order to safely resist excessive wave force the latter type of structure requires a sea slope of heavy riprap corresponding to the sea slope of the rubble mound or stone type. With this sea slope added, the timber-concrete type becomes largely of the stone construction, and it would be more advantageous to go a step further, where applicable and advisable, and omit the difficult timber-concrete superstructure construction and substitute a stone construction therefor, possessing all of the elements of permanency of concrete and many advantages over that class of work in flexibility of construction.

At Oswego a sea slope of heavy riprap is considered essential, and the condition of the existing crib substructure is not very favorable, owing to its weakness and irregular alignment, to the construction of concrete superstructure upon it. It is therefore considered a plain case where it would be most advantageous and advisable to go the step further and build the superstructure of stone, with certain special treatments to meet local conditions and requirements. In this estimate, therefore, the stone type of construction is adopted.

The outer breakwater at Oswego is composed of a series of stone-filled timber cribs, 35 feet square, except a few, which were built 70 feet long. These cribs are all sunk upon the natural sand and clay bottom of Lake Ontario, except those of the easterly 1,390 feet, which were placed upon a stone foundation in a dredged trench. Many of the cribs sunk on the natural bottom settled out of line, and the result is a bad alignment of the structure. The cribs were sunk in juxtaposition and surmounted by a continuous timber superstructure, the parapet of which is 12 feet wide and about 13 feet high above low water (zero of Oswego gauge), except on the southerly 846 feet of the west shore arm, where the parapet is only 9 feet high. The banquette is generally 23 feet wide and 5 feet high above low water.

The total revised and checked length of the breakwater is 6,031 feet, as follows:

| | Feet. |
|---|---|
| Channel arm | 246 |
| Main breakwater to breach of 1884 | 4,212 |
| Breach of 1884 | 163 |
| Main breakwater west of breach of 1884 | 494 |
| West shore arm | 916 |
| Total | 6,031 |

The existing project provides for maintaining an opening 75 feet wide in the breach of 1884 for water circulation.

The lengths of the several parts of the breakwater therefore to be repaired and rebuilt, with the narrowing of the breach as required by the project provided for, is as follows:

| | Feet. |
|---|---|
| Channel arm | 246 |
| Main breakwater to breach narrowed to 75 feet | 4,256 |
| Main breakwater west of breach narrowed to 75 feet | 538 |
| West shore arm | 916 |
| Total | 5,956 |

The several parts of the breakwater will require different treatment to meet local conditions and requirements, and to meet these three designs of structure are considered necessary.

There is submitted herewith a tracing on which is shown an index map of the Oswego outer breakwater and the three designs of structure referred to. The lengths of structure to be constructed of the different designs are indicated on the index map.

## THE CHANNEL ARM.

At the easterly end the channel arm, 246 feet long, is on the side of the entrance channel and should not be provided with a sea slope of riprap stone. It is exposed only to infrequent northeast seas of not great severity. The crib substructure must, however, be strengthened by bolting corner posts in the cribs to the depth of about 16 feet, and it will be necessary to place a buttress crib in extension lakeward 40 feet on the line of the channel arm to hold the sea slope proposed for the main breakwater at its eastern end.

The superstructure on the channel arm is designed to be similar to that of the main breakwater, which it joins, for 76 feet from the junction or corner, but without a sea slope; while the superstructure over the southerly 170 feet is designed to be flat and only 6 feet above low-water level to admit of a clear view across it from vessels entering or leaving the harbor.

This portion of the channel arm, 170 feet long, would be of the design shown therefor on the tracing and would be built of concrete in order to secure the needed strength on this low section.

### MAIN BREAKWATER TO BREACH NARROWED TO 75 FEET.

This part of the breakwater is 4,256 feet long. It is used for mooring purposes by vessels loaded or waiting for loads and by vessels which seek refuge in the outer harbor in storms. The bottom of the harbor is poor holding ground for anchorage, and there is not room for vessels to swing at anchor. Mooring to the breakwater is therefore considered essential and necessary for the security of vessels in stress of weather, and this feature has been provided for in the design for the repair of this section of the breakwater.

The reconstruction would be of the stone design as shown on the tracing. This design is essentially the same as that of the rubble mound or stone breakwater at Buffalo Harbor. The existing crib substructure, however, forms a secure foundation and back wall, and admits of constructing a banquette and providing the necessary mooring facilities thereon. This banquette is designed to be of concrete to secure strength and smoothness of finish.

The stone portion of the construction, viz, the sea slope and the parapet, is composed of a hearting of rubblestone covered with a rough paving of capping stone, all as shown on the tracing. The capping stones are to be 6 feet thick and in blocks weighing from 4 to 14 tons, averaging about 6 tons.

The proposed construction implies the tearing out of the existing timber superstructure to low-water level, the timber and bolts therein to be disposed of and the stone filling to be utilized as hearting for the parapet and banquette, and the surplus, if any, as hearting in the sea slope.

At the westerly end of this section, at the breach or gap, a substructure of cribwork would be required to form a buttress for the sea slope at the gap. This would be secured, in connection with the required narrowing of the breach to 75 feet, by placing a new crib 70 feet long, 44 feet wide, and 18 feet high in the breach, and extending 35 feet lakeward from the lake face. This crib would secure one-half the required closure of the breach or gap and at the same time supply the needed buttress for the sea slope at the gap. A similar crib on the other side of the gap would secure the other half of the required closure of the gap and the needed buttress on that side.

### MAIN BREAKWATER WEST OF BREACH NARROWED TO 75 FEET.

This part of the breakwater is 538 feet long. It is not used or required for the mooring of vessels, and for this reason a banquette would not be required. The reconstruction would be of the stone design, similar to that for the main breakwater east of the gap, except that the parapet is carried over to the back wall and the concrete banquette omitted, as shown on the tracing.

The proposed construction implies the tearing out of the existing timber superstructure to low-water level and the utilization of stone filling in a manner similar to the east section.

### THE SHORE ARM.

This part of the breakwater is 916 feet long. It is not used for the mooring of vessels and no banquette is required.

The reconstruction would be of the stone design similar to that for the main breakwater west of the gap. For 316 feet from the junction with the main breakwater the structure would be of the full size required for the main breakwater, but for the 600 feet thence shoreward the sea slope would gradually decrease in size with the decrease in depth of water to nothing at the shore end.

This decreasing construction is shown on the tracing by a mean cross section for a depth of 10 feet of water, the depth along the 600 feet ranging from 20 feet to zero at the shore. The proposed construction implies the tearing out of existing timber superstructure to low water and the utilization of filling stone as in other sections.

## REMARKS.

The breakwater designs herein considered and used as a basis of estimate of cost are essentially of the rubble mound or stone type, which implies the use of large quantities of rubblestone, consisting of irregularly-shaped masses of stone ranging in weight from a few pounds up to several tons; and also of large capping stone which must be in blocks approximately parallelopipedal in shape and ranging in weight from 3 to 14 tons or more. This capping stone should be uniformly about 6 feet in one dimension and not less than 3 feet thick on the bed. A quarry that can supply the requisite capping stone will inevitably supply the rubblestone as a by-product in the process of quarrying capping stone.

In the adoption of the stone design of breakwater it is evident that the matter of an adequate supply of the requisite stone must be a prime consideration.

In the case of the proposed Oswego breakwater work it may be stated that the conditions are favorable for securing an ample supply of the required capping and rubblestone at a reasonable cost from quarries in the vicinity of Chaumont Bay, New York, at the eastern end of Lake Ontario, and about 45 miles distant from Oswego Harbor.

The stone here found is a Trenton limestone, which is extensively used for building purposes, and is known to withstand weather effects and to admit of dressing to good surfaces if required.

This stone quarries readily in well-shaped masses of a thickness of several feet, and can be obtained in unlimited quantities. There are good facilities for transporting the stone by water from the quarries to Oswego.

## ESTIMATE OF COST.

The cost of the permanent repair of the Oswego breakwater, in accordance with the designs hereinbefore described and shown on the drawings herewith, is estimated as follows:

### *The channel arm.*

[Length, 170 feet, A to B, as marked on the index map herewith.]

| | |
|---|---|
| Removing timber superstructure and stone filling, leveling cribs for foundation for concrete blocks, and replacing stone filling in superstructure | $1,700 |
| Strengthening crib substructure with corner posts, 170 linear feet, at $20 per linear foot | 3,400 |
| Concrete blocks in place, 410 cubic yards, at $10 per cubic yard | 4,100 |
| Mass concrete in place, 648 cubic yards, at $8 per cubic yard | 5,184 |
| Manhole covers, mooring rings, fenders, etc | 1,000 |
| | 15,384 |
| Contingencies and engineering, 12½ per cent | 1,923 |
| | 17,307 |

### *The main breakwater, east of gap, narrowed to 75 feet, and 76 feet of the channel arm.*

[Length, 4,256 + 76 = 4,332 feet, B to C, as marked on the index map herewith.]

| | |
|---|---|
| Removing timber superstructure and stone filling, leveling cribs for foundation for concrete blocks, and replacing stone filling in superstructure, 4,288 linear feet, at $15 per linear foot | $64,320.00 |
| Strengthening crib substructure with corner posts, 76 linear feet, at $20 per linear foot | 1,520.00 |
| Buttress cribs, filled in place, at east end, 40 by 30 by 18 feet, in gap, 70 by 44 by 18 feet, 110 linear feet, at $100 per linear foot | 11,000.00 |
| Rubble stone, in 4,256 linear feet of sea slope, at 20.27 tons per linear foot, 86,270 tons, at $1.25 per ton | 107,837.50 |
| Capping stone in 4,332 linear feet of sea slope and parapet, at 48.33 tons per linear foot, 209,365 tons, at $1.75 per ton | 366,388.75 |
| Concrete blocks in place in 4,332 linear feet of banquette, 2,816 cubic yards, at $10 per cubic yard | 28,160.00 |
| Mass concrete in place in 4,332 linear feet of banquette, 4,808 cubic yards, at $8 per cubic yard | 38,464.00 |
| Mooring devices, fenders, etc | 5,000.00 |
| | 622,690.25 |
| Contingencies and engineering, 12½ per cent | 77,836.28 |
| | 700,526.53 |

### *The main breakwater, west of gap, narrowed to 75 feet, and 316 feet of the west shore arm.*

[Length, 538+316=854 feet, D to E, as marked on the index map herewith.]

| | |
|---|---|
| Removing timber superstructure and stone filling and replacing stone filling in superstructure, 854 linear feet, at $15 per linear foot | $12,810.00 |
| Buttress crib, filled, in place, in gap, 70 by 44 by 18 feet, 70 linear feet, at $100 per linear foot | 7,000.00 |
| Rubblestone in 854 linear feet of sea slope, at 18.62 tons per linear foot, 15,901 tons, at $1.25 per ton | 19,876.25 |
| Capping stone in 854 linear feet of sea slope and parapet, at 49.16 tons per linear foot, 41,983 tons, at $1.75 per ton | 73,470.25 |
| | 113,156.50 |
| Contingencies and engineering, 12½ per cent | 14,144.56 |
| | 127,301.06 |

### *The west shore arm.*

[Length, 600 feet, E to F, as marked on the index map herewith.]

| | |
|---|---|
| Removing timber superstructure and stone filling and replacing stone filling in superstructure, 600 linear feet, at $15 per linear foot | $9,000.00 |
| Rubblestone in 600 linear feet of sea slope, at 3.1 tons per linear foot, 1,860 tons, at $1.25 per ton | 2,325.00 |
| Capping stone in 600 linear feet of sea slope and parapet, at 34.245 tons per linear foot, 20,547 tons, at $1.75 per ton | 35,957.25 |
| | 47,282.25 |
| Contingencies and engineering, 12½ per cent | 5,910.28 |
| | 53,192.53 |

In the foregoing estimates the stone filling in the existing timber work is computed as sufficient only for hearting required in the superstructures, because the existing structure is not completely filled with stone and much of it will probably be found to be disintegrated and not suitable for replacement. Any surplus over the amount required for the superstructures would be utilized as hearting in the sea slopes, with a corresponding saving in the amount of rubblestone to be purchased. In all cases "tons" are net tons of 2,000 pounds.

It will be noted that the contingencies and engineering are estimated at 12½ per cent instead of the usual 10 per cent.

This is considered necessary for the reason that all quantities of stone are estimated in the exact amount required without any allowance for settlement of the sea-slope stone into the sand bottom, upon which it would be built. Such settlement is quite likely to occur to an indeterminate extent.

The possible damage to the cribwork when cut down and exposed to seas, before the new superstructure can be placed, must also be considered, but is, of course, indeterminate. These items, with ordinary contingencies and the necessary extraordinary engineering supervision required on stone construction of this character, necessitate the estimation of contingencies and engineering as given.

*Summary estimate of cost.*

| | |
|---|---|
| The channel arm | $17,307.00 |
| Main breakwater: | |
| East of gap | 700,526.53 |
| West of gap | 127,301.06 |
| West shore arm | 53,192.53 |
| Total, including 12½ per cent for contingencies and engineering | 898,327.12 |

In round numbers, $900,000.

Very respectfully, your obedient servant,

THEO. A. BINGHAM,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

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## R R 12.

## ESTABLISHMENT OF HARBOR LINES AT OLCOTT HARBOR, NEW YORK.

INTERNATIONAL RAILWAY COMPANY,
*Buffalo, N. Y., June 24, 1903.*

DEAR SIR: This company has decided to improve its dockage facilities in Olcott Harbor, New York, and are preparing plans for building a dock, as shown in red on attached plan[a], 1164–12.

Having been informed that the first step to be taken was to have the harbor line established, we hereby respectfully request that this be done. On looking over the ground it appears that the most logical harbor line would be represented by straight line drawn from "A" to "B" and from "B" to "C" (see attached print[a]).

Thanking you in advance for the favor of an early reply, we are,

Yours, truly,

INTERNATIONAL RAILWAY COMPANY,
By T. W. WILSON, *Chief Engineer.*

Hon. ELIHU ROOT,
*Secretary of War, Washington, D. C.*

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[a] Not printed.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY.
*June 27, 1903.*

Respectfully referred to Maj. Theo. A. Bingham, Corps of Engineers, inviting attention to the provisions of section 11 of the river and harbor act approved March 3, 1899.

If, in Major Bingham's opinion, such action is essential to the preservation and protection of the harbor, he is authorized to consider and report upon the subject of the establishment of lines for the entire harbor.

After the matter has been carefully investigated and tentative lines have been drawn upon a convenient map, the whole subject will be considered at a public hearing, previously advertised, to be held in Olcott, N. Y., at which all interested parties will be given full opportunity to examine the proposed lines and express their views thereupon.

With his final report on the proposed lines Major Bingham will submit a tracing showing the lines, with proper description, which in his opinion will best subserve the various interests involved.

In this connection attention is invited to the fact that the matter of the establishment of harbor lines is one which should be treated with great care. The lines to be approved should be so marked and described that their position at any point of the locus may be determined with precision and without unusual difficulty, and the monuments to which they are referred should be such as are not likely to be disturbed by ordinary changes. Furthermore, the lines should be so fixed, with regard to present and future land and water interests, that the necessity for future modifications may be obviated so far as possible and thus reduce to a minimum the likelihood of embarrassing controversies arising, in which the rights of property and the efficiency of the work of the Department may be brought in question.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

U. S. ENGINEER OFFICE,
*Buffalo, N. Y., July 13, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, with report of this date.

THEO. A. BINGHAM,
*Major, Corps of Engineer.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*July 17, 1903.*

Respectfully returned to the Secretary of War.

The International Railway Company having requested that harbor lines be established in front of their property at Olcott Harbor, New York, the matter was referred to Maj. Theo. A. Bingham, Corps of Engineers, who has given it careful consideration, and attention is respectfully invited to his report of the 13th instant, herewith:

Major Bingham submits a tracing[a] on which is delineated in red the harbor line on the east side of the inner harbor of Olcott, whicl recommends be adopted as a coincident bulkhead and pierhead l and between which line and the present shore line no filling shoul done, unless it be confined by suitable permanent bulkheads. states in his report that the proposed harbor line has been agree by the International Railway Company.

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[a] Not printed.

I recommend that the line selected be approved, and that the Se tary place his approval on the tracing,[a] which has been prepared his signature.

A. MACKENZIE,
*Acting Chief of Engineer*

NOTE.—The lines referred to and shown on the map mentioned v approved by the Secretary of War July 20, 1903.

### REPORT OF MAJ. THEO. A. BINGHAM, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Buffalo, N. Y., July 13, 190*

GENERAL: I have the honor to submit the following report on establishment of a harbor line at Olcott Harbor, New York, in formity with the second indorsement.

The blueprint accompanying the application for the harbor lin the International Railway Company shows the property, along wl they desire a harbor line, as owned by the Lockport and Olcott R way. This company was absorbed by the International Rail Company, and the property is known to belong to the latter comp by deeds on record in Niagara County, N. Y., and by the approva Frehsee and Olmsted, engineers and surveyors in Niagara County shown on the blueprint.

The International Railway Company is therefore the proper ap cant as owner of all the land on the east side of what may be called present inner harbor of Olcott, beyond the United States piers. Main Street Bridge is a fixed bridge, and the water area above bridge is not used at present for any commercial purpose; nor i likely to be for some years to come.

The establishment of the harbor line as applied for by the In national Railway Company would therefore meet all immediate prospective requirements for an indefinite period.

It may be further stated that there is at present no call for est lishing a harbor line on the west side of the harbor. The propo harbor line, shown on the tracing[a] submitted herewith, is practic coincident with the channel limit on the east side specified in present project for the improvement of Olcott Harbor. The char limit of the proposed project on the west side is also shown on tracing. Should the commerce of Olcott Harbor be developed to extent proposed by the International Railway Company, it is prob that this company will further develop its facilities by constructin turning basin on the west side of the harbor. The establishment harbor line on the west side, therefore, will not be advisable necessary until the International Railway Company, or other prop owners on that water front, can determine what their needs will be. The west side is at present occupied only by a few small boat houses.

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[a] Not printed.

From data for locating and describing the proposed harbor line on hand at this office a tracing[a] has been prepared and is submitted herewith, on which is delineated in red and described a harbor line which, in my opinion, should be adopted at the locality as a coincident bulkhead and pierhead line, and between which line and the present shore line no filling should be done unless it be confined by suitable permanent bulkheads.

The proposed harbor line has been agreed to by the International Railway Company.

Very respectfully, your obedient servant,

THEO. A. BINGHAM,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

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[a] Not printed.

# APPENDIX S S.

## IMPROVEMENT OF RIVERS AND HARBORS IN CALIFORNIA SOUTH OF SAN FRANCISCO.

*REPORT OF CAPT. C. H. McKINSTRY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. San Diego Harbor, California.
2. Deep-water harbor at San Pedro Bay, California.
3. Wilmington Harbor, California.
4. San Luis Obispo Harbor, California.

EXAMINATIONS.

5. Colorado River between Eldorado Canyon and Rioville, Nevada.
6. Colorado River, Arizona and California, from Yuma to the Mexican boundary line.
7. Santa Cruz Bay, California.

United States Engineer Office,
*Los Angeles, Cal., July 14, 1904.*

General: I have the honor to forward herewith annual report on works of river and harbor improvement in my charge for the fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

C. H. McKinstry,
*Captain, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. Army.*

## S S 1.

### IMPROVEMENT OF SAN DIEGO HARBOR, CALIFORNIA.

*The jetty.*—Under contract entered into April 1, 1903, with A. E. Babcock, 104,850 tons of stone was delivered during the fiscal year at a cost, including engineering and all other expenses, of $196,964.07. The total amount of stone to be delivered under this contract is 108,108 tons and the contract is about 95 per cent completed. The jetty has been extended from station 45+95 to its full projected length of 7,500 feet.

*Dredging outer bar.*—Under contract dated November 20, 1902, with A. A. Polhamus, the work of dredging the outer bar was begun July 10, 1903, and was completed February 13, 1904, 123,567 cubic yards having been removed. The total cost of the work, including engineering and all other expenses, was $38,686.10. A channel 26 feet deep and 271 feet wide (28 feet deep over a width of 171 feet) was excavated. Soundings taken in June indicated no deterioration.

*Dredging middle ground.*—Under contract dated February 27, 1904, with A. A. Polhamus, for dredging the middle ground work was begun March 10, 1904, and was suspended April 16, 1904, the dredge having been run into and sunk by the *State of California.* Up to April 16, 1904, 34,343 cubic yards had been removed at a cost, including engineering and all other expenses, of $8,600.94. The result of this work was a channel 200 feet wide and 28½ feet deep, which has since shoaled to about 26 feet. It is expected that dredging will be resumed in July.

The available balance will be applied to the completion of the contracts now in force. Any additional funds appropriated should be applied to the maintenance of the channels through the outer bar and the middle ground.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $265, 776. 08 |
| October 12 and 22, 1903, refundment by division engineer on account purchase of unlimited railroad ticket | 3. 26 |
| | 265, 779. 34 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 209, 907. 54 |
| July 1, 1904, balance unexpended | 55, 871. 80 |
| July 1, 1904, outstanding liabilities | 23, 822. 47 |
| July 1, 1904, balance available | 32, 049. 33 |
| July 1, 1904, amount covered by uncompleted contracts | 28, 073. 04 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 15, 000. 00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

AMOUNT AND DATE OF ALL APPROPRIATIONS FOR THE WORK SINCE 1875.

| | | | |
|---|---|---|---|
| March 3, 1875 | $80, 000. 00 | June 3, 1896 | $50, 000. 00 |
| March 3, 1879 | 1, 000. 00 | March 3, 1899 | 65, 000. 00 |
| August 11, 1888 | 1, 000. 00 | June 13, 1902 | 75, 000. 00 |
| September 19, 1890 | 60, 500. 00 | March 3, 1903 | 192, 850. 00 |
| July 13, 1892 | 50, 000. 00 | | |
| August 18, 1894 | 50, 000. 00 | Total | 625, 350. 00 |

### ABSTRACT OF ALL CONTRACTS IN FORCE.

*Contract for dredging on outer bar.*

Name of contractor: A. A. Polhamus.
Contract entered into November 20, 1902; approved December 4, 1902.
Work to begin July 10, 1903; contract to be completed November 11, 1903.
Contract for dredging 122,807 cubic yards, at 28½ cents per cubic yard.

*Contract for completing jetty.*

Name of contractor: A. E. Babcock.
Contract entered into April 1, 1903; approved April 18, 1903.
Work to begin June 26, 1903; contract to be completed December 26, 1904.
Contract for delivery of 108,108 tons (of 2,000 pounds each) of rubblestone, at $1.85 per ton.

*Contract for dredging on middle ground.*

Name of contractor: A. A. Polhamus.
Contract entered into February 27, 1904; approved March 10, 1904.
Work to begin May 14, 1904; contract to be completed November 2, 1904.
Contract for dredging 84,444 cubic yards, at 22½ cents per cubic yard.

### COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1903.

[Furnished by the collector of customs at San Diego, Cal.]

| | Incoming. | Outgoing. |
|---|---|---|
| Vessels: | | |
| Steam | 191 | 189 |
| Sailing | 35 | 36 |
| Total | 226 | 225 |
| Tonnage | 194,824 | 67,330 |
| Draft, greatest .......... feet.. | 24½ | 24 |
| Lumber .......... do.... | 19,486,000 | 440,000 |
| Merchandise .......... tons.. | 16,547 | 12,829 |
| Coal .......... do.... | 32,673 | 168 |
| Cement .......... do.... | 22,463 | 92 |
| Ores .......... do.... | 375 | 1,199 |
| Grain .......... do.... | .......... | 5,508 |

Total amount of freight entered and cleared in 1903, 131,706 tons, an increase of 25 per cent over that of the preceding year.

No lines of transportation have been established or abandoned during the year.

## S S 2.

## DEEP-WATER HARBOR AT SAN PEDRO BAY, CALIFORNIA.

The construction of the breakwater was continued during the year, under continuing contract dated June 7, 1900, with the California Construction Company, of San Francisco, Cal.

At the beginning of the fiscal year 1,118,783 tons of stone had been deposited in the substructure, which had been raised to mean lower low water and was about completed for the length of 5,715 feet from its westerly end, and 21,242 tons had been placed in the superstructure, no part of which was completed.

During the fiscal year ending June 30, 1904, 134,072 tons of sandstone and 313,238 tons of granite, a total of 447,310 tons, was placed in the substructure, and 22,034 tons of stone in the superstructure.

This makes a total of 1,566,093 tons in the substructure, of 43,276 tons in the superstructure, and of 1,609,369 tons under the contract. During the fiscal year the double-track trestle was extended 1,666 feet, making its total length 7,876 feet.

The substructure is to mean lower low water and about completed for a length of 7,284 feet, and some stone has been deposited for the further distance of 416 feet. Work has been done on the superstructure over a length of 1,919 feet, commencing 636 feet from the westerly end of the breakwater. The amount of stone placed in the superstructure is equivalent to about 1,400 feet of completed work. So far as the rate of delivery is concerned the contractor is ahead of the requirements of the contract. The contract is about 61 per cent completed.

The work on the breakwater, particularly the substructure, has already advanced far enough to shelter, in stormy weather, a large anchorage area and the entrance to the inner harbor.

The total amount expended on this work to June 30, 1904, is $1,397,681.09.

The available balance, together with any additional appropriations, should be expended in extending the breakwater under contract and for contingencies.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $612,092.37 |
| Amount appropriated by sundry civil act approved April 28, 1904 | 350,000.00 |
| | 962,092.37 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 438,244.17 |
| July 1, 1904, balance unexpended | 523,848.20 |
| July 1, 1904, outstanding liabilities | 69,700.95 |
| July 1, 1904, balance available | 454,147.25 |
| July 1, 1904, amount covered by uncompleted contracts | 1,197,256.05 |
| Amount (estimated) required for completion of existing project | 743,108.80 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 400,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

AMOUNT AND DATE OF ALL APPROPRIATIONS FOR THE WORK.

| | |
|---|---|
| June 3, 1896 | [a] $50,000.00 |
| July 1, 1898 | 400,000.00 |
| March 3, 1899 | 200,000.00 |
| March 3, 1901 | 146,000.00 |
| June 28, 1902 | 311,085.00 |
| March 3, 1903 | 500,000.00 |
| April 28, 1904 | 350,000.00 |
| Total | 1,957,085.00 |
| Received from sale of property | .05 |
| Total | 1,957,085.05 |

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[a] Of the appropriation of $50,000 made by river and harbor act of June 3, 1896, for deep-water harbor at Santa Monica Bay, or San Pedro Bay, California, $35,555.76 was expended by the Board provided for by said act. For the full report of the Board, with its accompanying documents, see Senate Document No. 18, Fifty-fifth Congress, first session.

### ABSTRACT OF ALL CONTRACTS IN FORCE.

*Contract for construction of breakwater.*

Name of contractor: California Construction Company.

Contract entered into June 7, 1900; approved June 27, 1900. Work to begin August 4, 1900; contract to be completed June, 1906, provided adequate appropriations are made by Congress.

Rates:

For substructure stone, $0.844 per ton of 2,240 pounds.
For superstructure stone, $3.10 per ton of 2,240 pounds.
For concrete, $6 per cubic yard.

Quantities (estimated):

Stone in substructure, 1,985,958 tons; stone in superstructure, 221,025 tons; total, 2,206,983 tons.
Concrete, 2,370 cubic yards.

Total consideration of contract (approximate): $2,375,546.05.

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### COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1903.

For commercial statistics see report of Wilmington Harbor, California.

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## S S 3.

## IMPROVEMENT OF WILMINGTON HARBOR, CALIFORNIA.

*The dredge.*—Contract was entered into October 17, 1903, with the Ellicott Machine Company, of Baltimore, Md., in the sum of $98,400, for the construction of a 20-inch suction dredge. Work on the hull was begun March 8, 1904, and at the close of the fiscal year all the work that could be done on the hull in advance of the installation of the machinery was completed. The greater part of the machinery has been delivered at San Pedro and the work of installation is in progress. The cost of the work on the dredge to June 30, 1904, was $23,094.

*Pontons, discharge pipe, lumber, etc.*—All lumber required for the construction of derrick lighter, oil barge, water barge, and 24 discharge-pipe pontons has been ordered, and the greater part of it has been delivered. It is to cost $2,125.97. The following contracts have been entered into, viz, with H. E. Carse, May 6, 1904, for hardware required for construction of pontons, etc.; with Baker Iron Works, May 12, 1904, for furnishing 2,048 feet of 20-inch discharge pipe and 4 elbows; with New Jersey Car Spring and Rubber Company, May 14, 1904, for furnishing 25 rubber sleeves; and with H. E. Carse, June 8, 1904, for furnishing gasoline launch, with 16-horsepower "Standard" engine. A part of the hardware contracted for has been delivered. At the close of the fiscal year the hull of the launch was about 50 per cent completed.

*Dredging.*—Under the contract entered into November 24, 1902, with Raymond A. Perry, of Oakland, Cal., 234,339 cubic yards of material was removed, 89,588 cubic yards from alongside Deadmans Island (division A) and 144,751 cubic yards from the entrance above Deadmans Island and from the inner harbor along the docks on either side (division B), at a cost, including engineering and all other expenses, of $72,886.61. There had been removed during the preceding fiscal year 19,146 cubic yards from division A and 104,589 cubic yards from division B. The total quantity removed under the contract is 358,074 cubic yards, and the contract is about 97 per cent completed. At the entrance the dredging is being carried to the depth of 20 feet. The material is soft clay, hard clay, and fragmental rock. The map herewith shows the condition of the entrance and inner harbor June 30, 1904. The dredging in division A has been accompanied by the scouring of the outer bar, which now carries slightly more than 18 feet of water, a gain of nearly 3 feet over the governing depth at the beginning of the fiscal year.

So far as material removed is concerned the dredging project is about 11 per cent completed. The project as a whole, including repairs to east jetty and construction of dredge, as well as dredging, is about 20 per cent completed.

One of the minor items of the present project is the building of a restraining dike to divert the Los Angeles River from Wilmington Lagoon. At the time the project was adopted it was believed that the channels in the upper end of the lagoon were being filled to a sensible extent by material brought down by the river when in flood. The lowering of the low-water plane, due to an increase in the sectional area of the harbor entrance, will partly account for apparent evidences of fill. The provisions for taking care of the flood waters by drawing them off for irrigation are becoming more perfect all the time, and the quantity of material brought down by the river is less, on the average, every year. To construct the dike in question would be to close the slough leading to Long Beach, a channel of little present importance, but one that it may prove desirable to improve at some future day. It will likewise mean placing a barrier to the future development of Wilmington Harbor. In order that sudden floods might not do damage, it would be necessary to make and to maintain a new mouth for the river, a difficult and expensive work on a sandy coast. The best and most economical plan seems to be to give up the dike and to remove, by dredging from time to time, any material that may be deposited in the harbor channels. It is accordingly recommended that the project be modified by striking out the item calling for the building of this dike. (Authority for recommending modification of project is contained in Department indorsement of February 13, 1904.)

The amount expended under the existing project to June 30, 1904, is $108,815.65.

The available balance, together with additional appropriations, should be expended in completing the existing dredging contract, in constructing the dredge and its auxiliary floating plant, and in operating the dredge.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $276,582.86 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 84,895.19 |
| July 1, 1904, balance unexpended | 191,687.67 |
| July 1, 1904, outstanding liabilities | 10,792.50 |
| July 1, 1904, balance available | 180,895.17 |
| July 1, 1904, amount covered by uncompleted contracts | 103,484.42 |
| Amount (estimated) required for completion of existing project | 249,496.68 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 125,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

### AMOUNT AND DATE OF ALL APPROPRIATIONS FOR THE WORK.

| | | | |
|---|---|---|---|
| March 3, 1871 | $200,000 | August 11, 1888 | $90,000 |
| June 10, 1872 | 75,000 | September 19, 1890 | 34,000 |
| March 3, 1873 | 150,000 | July 13, 1892 | 51,000 |
| March 3, 1875 | 30,000 | June 3, 1896 | 50,000 |
| June 18, 1878 | 20,000 | June 13, 1902 | 250,000 |
| March 3, 1879 | 12,000 | | |
| June 14, 1880 | 35,000 | Total | 1,255,000 |
| March 3, 1881 | 33,000 | Received from sale of property | 1 |
| August 2, 1882 | 100,000 | | |
| July 5, 1884 | 50,000 | | |
| August 5, 1886 | 75,000 | Aggregate | 1,255,001 |

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### ABSTRACT OF ALL CONTRACTS IN FORCE.

*Contract for dredging.*

Name of contractor: Raymond A. Perry.

Contract entered into November 24, 1902; approved December 11, 1902.

Work to begin in division A, February 14, 1903; in division B, March 16, 1903. Contract to be completed, for division A, October 14, 1903; for division B, November 26, 1903. Date of completion extended to September 14, 1904.

Contract for dredging 120,000 cubic yards at 50 cents per cubic yard in division A, and 250,000 cubic yards at 16 cents per cubic yard in division B.

*Contract for construction of dredge.*

Name of contractor: Ellicott Machine Company.

Contract entered into October 17, 1903; approved November 6, 1903.

Work to begin December 12, 1903. Contract to be completed May 12, 1904. Date of completion extended to August 10, 1904.

Contract for construction of 20-inch suction dredge for $98,400.

*Contract for furnishing hardware for pontons.*

Name of contractor: H. E. Canse.

Contract entered into May 6, 1904; approved June 3, 1904.

Delivery to be made July 24, 1904.

Amount of contract, $1,049.09.

*Contract for furnishing discharge pipe.*

Name of contractor: Baker Iron Works.

Contract entered into May 12, 1904; approved June 3, 1904.

Delivery to be made August 8, 1904.

Contract for furnishing 2,048 feet of 20-inch discharge pipe and 4 elbows for $3,023.08.

*Contract for furnishing rubber sleeves.*

Name of contractor: New Jersey Car Spring and Rubber Company.

Contract entered into May 14, 1904; approved June 17, 1904.

Delivery to be made August 22, 1904.

Contract for furnishing 25 rubber sleeves, 21½ inches diameter, 3 feet long, for $1,275.

*Emergency contract for launch.*

Name of contractor: H. E. Canse.

Contract entered into June 8, 1904.

Work to begin June 8, 1904; contract to be completed July 20, 1904.

Contract for gasoline launch, 30 feet long, 7-foot beam, with 16-horsepower "Standard" engine, for $1,732.50.

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1903.

[Furnished by the collector of customs at Los Angeles, Cal.]

| | Incoming. | Outgoing. |
|---|---|---|
| Vessels: | | |
| Steam | 879 | 872 |
| Sailing | 387 | 382 |
| Total | 1,266 | 1,254 |
| Tonnage | 477,193 | 425,158 |
| Draft, greatest . . . feet | 21 | 18 |
| Merchandise, general . . . tons | 20,200 | 12,367 |
| Lumber . . . feet | 362,519,101 | .......... |
| Crude oil . . . barrels | 22,900 | 33,400 |
| Cement . . . do | 13,500 | .......... |

Total amount of freight entered and cleared in 1903, 769,404 tons, an increase of 30 per cent over the preceding year.

No lines of transportation have been established or abandoned during the year.

## S S 4.

## IMPROVEMENT OF SAN LUIS OBISPO HARBOR, CALIFORNIA.

At the beginning of the fiscal year there was in force a contract, entered into February 14, 1903, with A. A. Polhamus for breakwater construction. When work began under this contract the breakwater had been completed for a distance of 700 feet from Whaler Island and partially built for the further distance of 300 feet. The 4,711 tons of stone delivered under this contract during the fiscal year ending June 30, 1903, was used in building up the 300 feet of partially completed work in order to afford shelter to the floating plant.

During the fiscal year ending June 30, 1904, 20,476.5 tons of stone was delivered, at a cost, including engineering and all other expenses, of $48,021.08, and the breakwater was completed to a point 1,160 feet from Whaler Island. The contract was completed October 13, 1903. During the past winter the outer 100 feet of the breakwater was somewhat beaten down by the waves.

The total amount expended on the construction of this breakwater to June 30, 1904, is $279,333.56, and the project is about 50 per cent completed.

The available balance, together with any additional appropriations, should be expended in extending the breakwater under contract and for contingencies.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $48,688.47 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 48,021.08 |
| July 1, 1904, balance unexpended | 667.39 |
| Amount (estimated) required for completion of existing project | 288,659.05 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 100,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

### AMOUNT AND DATE OF ALL APPROPRIATIONS FOR THE WORK.

| | |
|---|---|
| August 11, 1888 | $25,000.00 |
| September 19, 1890 | 40,000.00 |
| July 13, 1892 | 30,000.00 |
| August 18, 1894 | 40,000.00 |
| June 3, 1896 | 40,000.00 |
| March 3, 1899 | 55,000.00 |
| June 13, 1902 | 50,000.00 |
| Total | 280,000.00 |
| Received from sale of property | .95 |
| Total | 280,000.95 |

### ABSTRACT OF ALL CONTRACTS IN FORCE.

*Contract for continuing construction of breakwater.*

Name of contractor: A. A. Polhamus.

Contract entered into February 14, 1903; approved March 20, 1903.

Work to begin May 25, 1903; contract to be completed November 25, 1903.

Contract for delivery of 25,269 tons (of 2,000 pounds each) of rubblestone at $1.86 per ton.

### COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1903.

[Furnished by the Pacific Coast Railway Company.]

| | Incoming. | Outgoing. |
|---|---|---|
| Vessels: | | |
| Steam | 225 | 225 |
| Sailing | | |
| Total | 225 | 225 |
| Tonnage | 130,057.0 | 130,057.0 |
| Draft, greatest ... feet | 15.0 | 15.0 |
| Merchandise, general ... tons | 7,255.7 | 1,896.2 |
| Coal ... do | 713.9 | |
| Lumber ... feet | 6,273,891.0 | 7,281.0 |
| Grain ... tons | 371.6 | 35,990.3 |
| Bituminous rock ... do | | 1,272.5 |
| Dairy products ... do | 9.4 | 216.2 |
| Live stock ... do | | 4.0 |

Total amount of freight entered and cleared in 1903, 60,291 tons, an increase of 8.2 per cent over that of the preceding year.

No lines of transportation have been established or abandoned during the year.

## S S 5.

## EXAMINATION OF COLORADO RIVER BETWEEN ELDORADO CANYON AND RIOVILLE, NEVADA.

[Printed in House Doc. No. 237, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a report dated March 31, 1903, by Capt. Edgar Jadwin, Corps of Engineers, on preliminary examination of Colorado River, with a view to removing obstructions, etc., between Eldorado Canyon and Rioville, Nev., made in pursuance of a requirement in the river and harbor act approved June 13, 1902.

In Captain Jadwin's opinion the locality is not worthy of improvement by the General Government at this time, and this opinion is concurred in by the division engineer, Lieut. Col. D. P. Heap, Corps of Engineers. The Board of Engineers for Rivers and Harbors has reviewed this report in accordance with the provisions of sections 3 and 14 of the above-mentioned act, and the Board states in its report of May 21, 1903, that it is not desirable for the United States to undertake this improvement.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

## REPORT OF CAPT. EDGAR JADWIN, CORPS OF ENGINEERS.

United States Engineer Office,
*Los Angeles, Cal., March 31, 1903.*

General: In compliance with instructions contained in Department letter of June 23, 1902, I have the honor to submit the following report of a reexamination of the Colorado River, with a view to removing obstructions, deepening and rendering navigable the channel between Eldorado Canyon and Rioville, Nev.

No expenditures have been made for the improvement of navigation of the Colorado River, with the exception of $25,000, appropriated July 5, 1884, for the section immediately below the one now being reported upon, and $10,000, appropriated July 13, 1892, for the construction of a levee along the Gila River, near its junction with the Colorado River. Since that time several reports have been made upon the river, some of them covering the section now in question, and all of them unfavorable.

The last report was made by the late Capt. James J. Meyler, Corps of Engineers, September 29, 1900. His report and that of his assistant, Mr. L. C. Easton, assistant engineer, give a complete account of the physical and hydrographic conditions and of the previous navigation over the section.

I have recently traversed the 75 miles of river between Rioville and Eldorado Canyon in a skiff with Capt. J. A. Mellon, and incidentally the 87 miles from Eldorado Canyon to the railroad crossing at Needles. In this connection acknowledgment is made of the services of Captain Mellon, who is the oldest navigator on the river, and whose knowledge of it was of great assistance.

I found no material change in the conditions as described by Captain Meyler and Mr. Easton. The position of the section in question relative to other portions of the river and to the surrounding country is shown on the accompanying map.[a]

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[a] Not printed.

The Colorado is the longest river on the Pacific slope south of Alaska. It is said to have been navigated by the Spaniards as early as 1540, and has the unusual record of having been commercially navigated for 600 miles from its mouth before any improvement was made. With its tributaries it has an enormous drainage area, and is the only continuously flowing river in the Southwest. There can be no question that the time is coming when it will need to be utilized to its fullest extent for all the service it may be capable of rendering.

While its slope below Eldorado Canyon does not differ materially from that of other rivers in the United States improved by slack-water navigation, that between Rioville and Eldorado Canyon (about 4 feet to the mile) is greater than obtains in rivers usually so improved, excepting for comparatively short reaches around falls or rapids. Still so much of the bank is in canyon and the flow of water is so great (ranging approximately from 3,000 cubic feet per second at low water to over 40,000 cubic feet per second at high water) that much improvement can be made in the navigation at a comparatively reasonable cost. To provide for slack-water navigation would be extremely expensive. With an appropriation of, say, $60,000 a dredge and working boat could be built, and great improvement effected by removing threatening bowlders and dredging at some shoals. The dredge would be available for use on other parts of the river.

If the river were improved in this way it is not clear that it would result in any development of country within the next few years, principally because freight rates are so high from existing railroads to all points of the section. These rates are now controlled by the great length of wagon haul, or of water haul over the river from Needles to Eldorado Canyon. The former is not susceptible of much improvement except by the construction of railroads, which will shorten or do away with it altogether. The latter could be reduced considerably if the river were further improved between Needles and Eldorado Canyon.

There are some features which indicate that benefit would eventually result. The Geological Survey has taken initial steps looking to the use of the water farther down the river for irrigation purposes. This will naturally cause a great development of that country. There is also some increase in the mining being done along the upper river; also in the demand for navigation facilities on the river below Eldorado Canyon. It is claimed that large manganese deposits, lying along the river just below Rioville, must eventually be brought to market for use in the iron business, as the available supply of manganese elsewhere is rapidly being exhausted. Gold, gypsum, silver, and copper are also known to exist in the vicinity. The gold ore so far discovered is so poor that it is not profitably worked by existing methods. It can not be definitely stated whether methods now being developed will make it practicable to successfully work these ores in the near future.

The present commerce of the river between Rioville and Eldorado Canyon is practically nil. Since Captain Meyler's report three new steamboat lines have been organized, principally for business on the river between Eldorado Canyon and the Gulf of California. As yet they have carried very little freight, but it is expected that in the near future more will be handled.

A railroad now being constructed is expected to pass Las Vegas, distant some 20 miles, from which point there is said to be a practicable route for a branch to the river. There are rumors that the Arizona and Utah Railroad will be extended from Chloride to Rioville and that a new road will be built from a point on the Atchison, Topeka and Santa Fe Railroad through Searchlight to Quartette and Eldorado Canyon. There also has been a plan under consideration for the construction of a railroad in Utah down to Rioville in order that the manganese near the river may be brought into close connection with the coal in Utah.

Should any of the above possibilities be developed the situation might be greatly changed, possibly to such an extent that the improvement of the river would be justified. The section is so largely in canyon that for a number of years its traffic would probably be handled by boat rather than by a railroad, as the construction of the latter up and down the river would be extremely expensive.

Should the canyon portion of the river ever be improved sufficiently to justify the establishment of regular lines of steamers it would probably become one of the favorite scenic and tourist routes of the world.

In view of the improbability that any work of improvement would result in corresponding benefit to the country or development of commerce in the reasonably near future, I am of the opinion that the Colorado River between Eldorado Canyon and Rioville is not worthy of improvement by the General Government at this time.

Very respectfully,

EDGAR JADWIN,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, PACIFIC DIVISION,
*San Francisco, Cal., April 2, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in recommendation in paragraph 14 of this report.

D. P. HEAP,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

Additional information has been called for, if available.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., May 21, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer, the indorsement of the division engineer, and other data available.

The Colorado River between Rioville and Eldorado Canyon is reported to have a low-water fall of 270 feet in a distance of 65 miles. Any improvement worthy of the name would involve canalization at great expense. The Colorado River below Eldorado, about 500 miles in length, is not at present in excellent navigable condition, and for any distance above Rioville navigation would never be possible under any circumstances.

The country bordering upon the river is as a rule barren, though believed to be rich in mineral deposits. There is no present commerce upon this section of river, and it is believed that none would develop of value commensurate with the cost of improvement.

For the reason stated the Board is of opinion that it is not desirable for the United States to undertake the improvement of the Colorado River between Eldorado Canyon and Rioville, Nev.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## S S 6.

### PRELIMINARY EXAMINATION OF COLORADO RIVER, ARIZONA AND CALIFORNIA, FROM YUMA TO THE MEXICAN BOUNDARY LINE.

[Printed in House Doc. No. 204, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith a report, dated January 22, 1903, by Capt. Edgar Jadwin, Corps of Engineers, on preliminary examination of Colorado River, Arizona and California, from Yuma to Mexican boundary line, ordered by the river and harbor act of June 13, 1902.

In the opinion of Captain Jadwin, the division engineer, Lieut. Col. D. P. Heap, Corps of Engineers, and the Board of Engineers for Rivers and Harbors, which has reviewed this report, in pursuance of the provisions of sections 3 and 14 of the above-mentioned act, the locality is not worthy of improvement by the United States.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

## REPORT OF CAPT. EDGAR JADWIN, CORPS OF ENGINEERS.

United States Engineer Office,
*Los Angeles, Cal., January 22, 1903.*

General: I have the honor to submit the following report on the preliminary examination of the Colorado River from Yuma to the Mexican boundary line.

Several explorations of portions of the Colorado River have been made, of which those by Lieut. J. C. Ives, of the Topographical Engineers, in 1856 and 1857; by Maj. J. W. Powell, of the United States Geological Survey, from 1869 to 1872, and by Lieut. Geo. M. Wheeler, Corps of Engineers, in 1875 (for latter see Report of Chief of Engineers, 1876, Part 3, pp. 329–345), are well known. A number of examinations of portions of the river above Yuma have been made by officers of the Corps of Engineers with a view to their improvement. The reports of these officers have generally been unfavorable, and, with the exception of the expenditure of $25,000, appropriated July 5, 1884, for the reach between Mojave and El Dorado Canyon, and $10,000 appropriated July 13, 1892, for the construction of a levee along the Gila River near its junction with the Colorado River, so as to confine the waters to the channels of said river, no improvements for navigation purposes have been made by the General Government. Lieut. Col. C. E. L. B. Davis, Corps of Engineers, submitted a report September 7, 1896, on the whole river, which was also unfavorable. An exhaustive report on the lower portion of the river was made in 1851 by Lieut. Geo. H. Derby, of the Topographical Engineers, who had been sent to examine and survey a route for the transportation of supplies for troops operating in Arizona, New Mexico, etc.

The accompanying maps[a] show the portion of the river under examination and its relation to the entire river. The Mexican boundary line reaches the river 20 miles below the junction of the Gila and Colorado rivers at Yuma, follows it northerly to a point 6 miles south, and then leaves it, going in a westerly direction. The lower boundary is understood to be the one referred to in the order for the examination. The length of river under examination is 31 miles, following the thread of the channel as measured on map prepared by the Boundary Commission. According to Lieutenant Derby's map the head of tide water and the mouth of the river are respectively 82 and 141 miles below Yuma.

Mr. R. B. Marshall, in charge of the United States Geological Survey party now operating in the vicinity of Yuma, informed me that the elevation of the water surface at Yuma January 2, 1903, was 119.4 feet above mean sea level and that the elevation of the water surface at the boundary line on the same day was 85.7 feet above sea level.

My examination was made in a skiff in company with Capt. J. A. Mellon, who has navigated the river for years. Captain Mellon's long experience and familiarity with the history and conditions surrounding navigation on the river were of the greatest service in making this examination.

The river at the time of the examination was very near dead low water. Its velocity was about 2 feet per second. The flow at Yuma has been gauged frequently. The following table has been compiled principally by Mr. J. B. Lippincott, resident hydrographer of the United States Geological Survey:

---

[a] Not printed.

| Date. | Hydrographer. | Gauge height. | Discharge per second. |
|---|---|---|---|
| | | *Feet.* | *Cubic feet.* |
| 1854 | Lieutenant Michler | | 6,250 |
| March 15, 1876 | Lieutenant Bergland | | 7,659 |
| January 17, 1895 | J. B. Lippincott | 20.3 | 9,737 |
| April 18, 1895 | do | 20.2 | 21,094 |
| July 10, 1896 | do | 21.2 | 45,633 |
| May 20, 1896 | do | 22.2 | 57,903 |
| January 9, 1902 | do | 17.2 | 3,637 |
| February 20, 1902 | S. G. Bennett | 17.15 | 3,239 |
| May 30, 1902 | do | 23.00 | 38,400 |
| July 9, 1902 | do | 20.52 | 11,799 |
| July 7, 1902 | W. W. Follett | 21.06 | 18,350 |
| October 11, 1902 | S. G. Bennett | 18.5 | 6,030 |
| October 14, 1902 | R. P. H. Laney | 17.8 | 4,798 |
| October 17, 1902 | do | 17.5 | 3,559 |
| October 21, 1902 | do | 17.6 | 4,293 |
| October 24, 1902 | do | 17.5 | 3,547 |

At the time of my examination the water course varied greatly in width, the narrowest point being estimated at about 80 feet. The water is extremely muddy. There are many bars, principally of sand, with some mud and clay. About a dozen of them had between 2 and 3 feet of water on them. Two had less than 2 feet. Captain Mellon informed me that the river had been low for some time, and that the depth of water on the shoals was therefore somewhat greater than was usual for the same gauge reading. A rise of a few feet gives the river a width between its first banks of nearly a thousand feet in most places. These banks, which are generally lined with vegetation, rise about 6 feet above the low water. Back some distance from them there is another rise of about 3 feet, called the second bank. These elevations are only general, the bottom lands being cut up in many places with sloughs. The line of the high mesa is shown on the accompanying map.[a] The bottom lands are fairly well covered with a growth of mesquite, willow, and cottonwood trees, and with hemp, arrow weed, creosote plant, and other shrubbery and undergrowth.

These lands on the eastern side have recently been thrown open to settlement, and many farms are now being located there. These farms rely on water from the river for irrigation. At a point about 9 miles below Yuma on the west bank a canal, taking out about 20 per cent of the water at low water for use in the new Imperial country, to the west of the river, has been put in by the Imperial Land and Water Company. I also saw portions of the land irrigated by water taken out by the Farmers' Land and Water Company and the Ludy Land and Water Company.

These companies have not as yet taken out sufficient water to materially interfere with navigation. Fortunately the period of the year when the land requires the greatest amount of irrigation coincides with the time of higher water on the river. I understand that United States geological surveys are now being made under the new irrigation law, with the general idea of providing eventually for the irrigation of all or nearly all the bottom lands along the river.

Yuma is a town of about 1,400 population. It is supplied by one railroad, the main line of the Southern Pacific Company, from east to west. This road during the past year took into Yuma the following amount of freight:

---

[a] Not printed.

| | Tons. |
|---|---|
| Merchandise | 4,053 |
| Coal | 15 |
| Lumber | 946 |
| Agricultural products | 1,458 |
| Minerals | 33 |

It took out of Yuma:

| | Tons. |
|---|---|
| Merchandise | 1,326 |
| Lumber | 14 |
| Agricultural products | 1,024 |
| Minerals | 79 |

The commerce of the river below Yuma is very much less than that above. It is handled at present principally by two vessels, the *Cochan*, a stern-wheel steamer, 159 feet by 32 feet 8 inches, drawing 20 inches light, and the *St. Vallier*, stern-wheel steamer, 75 feet by 17 feet. Photographs[a] of both vessels are transmitted herewith. They operate usually by taking their cargoes on large flatboats, which they tow. A small amount is also taken down river on flatboats, drifting with the current or towed by small launches.

The best information available indicates that the total tonnage down the river from Yuma during the past year did not exceed 500 tons. Very little was brought up the river to Yuma.

The boats could without any improvement to the river probably handle conveniently 15,000 tons a year from Yuma to Port Isabel, at the mouth of the river, where larger-draft ships may come to discharge.

I am informed that in former years 28 sailing vessels and 2 steamers were for some time employed in transporting supplies from San Francisco by ocean and Gulf of California to the mouth of the river. The supplies were then carried up the river on river steamers and barges to various landings in Arizona, whence they were hauled by teams to points where needed in Arizona and New Mexico. This business ceased with the construction of the trunk railroads through this territory from east to west.

If work were done now for the improvement of navigation, the first step should be to dredge through the shoals at the beginning of each low-water season, substantially as is done on the Mississippi River. Many people are interested in having a levee constructed along the eastern bank of the section of river covered by this examination. Such a levee would be valuable in protecting the fertile bottom lands from overflow. It would not be of much value at this time for the improvement of navigation.

Dredging, if done in connection with dredging and rock removal in the reaches above Yuma, would naturally be done by a boat traveling back and forth as its services were required. If the dredging were required over only a small reach, competition might be had between the small suction and dipper dredges now utilized for dredging in the irrigation canals.

In view of the above facts, particularly as the river is now capable of floating much more business on existing boats, I am of opinion that the expenditure of money for the improvement of the river simply for navigation purposes would not result in a corresponding benefit to commerce.

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[a] Not printed.

The irrigation of the bottom lands is expected to be followed by a large growth in population and commerce. It is also expected that the business on the river will increase in the near future, partly as the result of the development of these lands and partly because of the opening of mines in Mexico near the river. The construction of dams across the river for irrigation purposes may also improve the navigation. The question of placing locks in them should be considered in connection with their design, in order that the navigation of the river may, if it appears wise, be developed simultaneously with the growth of the adjacent country. The great expense necessary for the construction of locks and dams would not now be justified solely for the improvement of navigation.

In conclusion, I do not consider the Colorado River between Yuma and the Mexican boundary line worthy of improvement for navigation purposes at this time.

Very respectfully,

EDGAR JADWIN,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, PACIFIC DIVISION,
*San Francisco, Cal., January 27, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

I concur in the conclusions reached by Captain Jadwin.

D. P. HEAP,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 13, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has given due consideration to the within report of the district officer and the indorsement of the division engineer thereon.

The commerce of Colorado River below Yuma is at present insignificant. The condition of the stream is such that boats now in the trade can handle a much larger commerce than is offered.

running from some point in the county to Santa Cruz. A franchise and rights of way have been granted by the city council for a third line to San Francisco along the ocean shore. The Southern Pacific Railroad has large terminal facilities at San Francisco. It is not known to what extent the electric road; when constructed, may figure in the traffic situation. It is further hoped that a pipe line will be constructed to Santa Cruz from the oil fields in central California, and that an additional transcontinental line coming up through California will touch at Santa Cruz on its way to San Francisco. It must be admitted, however, that the present outlook is not promising for a trans-Pacific commerce.

As a harbor of refuge for coasting trade Santa Cruz and Monterey harbors, about 20 miles apart, are supplementary. Monterey Harbor is thororoughly protected from the storms which are most threatening at Santa Cruz, and vice versa. Both harbors are comparatively easy of access. It is the custom of the regular steamers, when it is too rough to land at Santa Cruz, to run over to Monterey first, and subsequently return to Santa Cruz. No vessel has been lost in Santa Cruz Harbor for forty years. Some were lost prior to that time. Six ships went ashore in one storm in 1852. Shippers rarely insure their cargoes.

The products of the county include large quantities of timber, bituminous rock, lime, wine, fruit, vegetables, and grain, two-thirds of which are stated to be shipped to San Francisco and the other third south and east. About 8,000 tons of these products, which is only a very small percentage of the whole, are shipped by water. The imports by water amount to less than 4,000 tons. The rates by water are about 15 per cent less than corresponding rates by rail. Formerly all freighting business was carried on by the vessels, but with the construction of the railroads this business diminished.

In view of the above-mentioned facts, it does not appear that the expenditure of the money required for the construction of a breakwater would, at the present time, or in the near future, result in a corresponding benefit to commerce. I have therefore to report that I do not consider the harbor at Santa Cruz worthy of improvement by the General Government at this time.

Very respectfully, your obedient servant,

EDGAR JADWIN,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, PACIFIC DIVISION,
*San Francisco, Cal., January 6, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

In view of the large cost of the improvement, and its relatively slight benefit to commerce, I concur in the recommendation of Captain Jadwin.

D. P. HEAP,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 13, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS.
*Washington, D. C., April 21, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer, the indorsement of the division engineer thereon, and other data available.

Previous examinations and reports on Santa Cruz Bay, California, indicate that the cost of the establishment of a harbor of the first class would be some millions of dollars. It is not probable that the present needs of general commerce demand another harbor so near San Francisco with sufficient urgency to warrant so large an expense. The needs of existing and prospective local commerce at Santa Cruz are fairly met at present. Monterey Bay, with its supplementary anchorages at Monterey and Santa Cruz, already furnishes reasonable refuge to shipping in storms.

For the reasons stated the Board is of opinion that it is not desirable that the United States should undertake the improvement of "Santa Cruz Bay, with a view to increasing the harbor facilities therein."

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

# APPENDIX T T.

## IMPROVEMENT OF RIVERS AND HARBORS IN CALIFORNIA TRIBUTARY TO AND NORTH OF SAN FRANCISCO BAY, AND OF PEARL HARBOR, HAWAII.

### *REPORT OF COL. W. H. HEUER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

#### IMPROVEMENTS.

1. Alviso Harbor, California.
2. Redwood Creek, California.
3. San Francisco Harbor, California.
4. Oakland Harbor, California.
5. San Pablo Bay, California.
6. San Joaquin River, California.
7. Rectification of Stockton and Mormon channels, California.
8. Mokelumne River, California.
9. Sacramento and Feather rivers, California.
10. Petaluma Creek and Napa River, California.
11. Humboldt Harbor and Bay. California.
12. Pearl Harbor, Hawaii.

#### EXAMINATIONS.

13. Belvedere Harbor, San Francisco Bay, California.
14. Napa River, California, above Mare Island Navy-Yard.

#### HARBOR LINES.

15. Easterly side of Mare Island Strait, at Vallejo, California.

United States Engineer Office,
*San Francisco, Cal., July 15, 1904.*

General: I have the honor to transmit herewith my annual reports of river and harbor works for the fiscal year ending June 30, 1904.

Very respectfully, your obedient servant,

W. H. Heuer,
*Colonel, Corps of Engineers*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## T T 1.

## IMPROVEMENT OF HARBOR AT ALVISO, CALIFORNIA.

A description of Alviso Slough and vicinity is printed in the Annual Report of the Chief of Engineers for 1891, page 2964.

With the exception of a resurvey made in April, 1904, in consequence of complaint from some parties interested in the improvement of the slough, no work has been done in the last fiscal year.

As neither commerce nor navigation has increased (in fact both have decreased) on this slough since the completion of the improvement, and as the channel obtained seems sufficient for existing commerce, I consider Alviso Harbor and Slough at present unworthy of further improvement.

As there is, however, $30,000 from unexpended balance and from collection of surety bond available for the improvement, which might be used for maintenance, and as Congress by act of June 13, 1902, made this unexpended balance available for extension and further improvement of the channel heretofore made, and as the people interested in the improvement have again been clamoring for the further improvement and expenditure of the money, it was deemed best to comply with the Congressional enactment to deepen and widen the existing channel.

Specifications for doing the work by contract are being prepared.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | [a]$30,312.28 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 261.15 |
| July 1, 1904, balance unexpended | 30,051.13 |

### APPROPRIATIONS.

| | |
|---|---|
| March 3, 1899 | $48,000 |
| Received from surety of failing contractor | 10,000 |
| Total | 58,000 |

### COMMERCIAL STATISTICS.

No statistics of commerce on Alviso Slough during the year 1903 could be obtained. The small steamer which formerly ran on the slough was taken off on January 4, 1903, and has not been run since, as there was not business to pay expenses. It is reported that one or two small schooners went into the slough during the year with cargoes of lumber and bark, but no record of their size or the amount of their cargoes could be obtained.

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[a] This item is greater than last year by $10,000 received from surety on bond of failing contractor.

## T T 2.

## IMPROVEMENT OF REDWOOD CREEK, CALIFORNIA.

The work for which Congress by act of June 13, 1902, appropriated $8,400 for the improvement of this creek was placed under contract in 1903 and completed on July 15 of that year. It resulted in a good channel across the middle ground, fully 5 feet below low-water level and 100 feet least width, as well as the completion of the dredging in front of the city wharf. The total volume of the material dredged was 72,154 cubic yards. The contract price for dredging was 11 cents per cubic yard, place measurement. It is reported by the tannery company that the dredged channel has again shoaled. No survey has been made since immediately after the completion of the work. As there is no tidal basin above the channel it can not be expected to be self-maintaining, but is at present sufficient for all the existing requirements of commerce.

No further appropriation in the near future for this work is believed to be necessary.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $6,854.44 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 6,497.10 |
| July 1, 1904, balance unexpended | 357.34 |

### APPROPRIATIONS.

| | |
|---|---|
| July 5, 1884 | $3,000 |
| August 5, 1886 | 5,000 |
| August 11, 1888 | 7,400 |
| September 19, 1890 | 8,000 |
| June 13, 1902 | 8,400 |
| Total | 31,800 |

### CONTRACT IN FORCE.

*Contract dated May 5, 1903, for dredging in Redwood Creek, California.*

Rate: 11 cents per cubic yard. Total cost, $8,042.66.
Name of contractor: Willis G. Witter.
Date of approval: June 2, 1903.
Work commenced: May 20, 1903.
Work completed: July 15, 1903.

### COMMERCIAL STATISTICS.

The commerce of Redwood Creek is carried on small scow schooners, which run regularly into the creek, and two small steamers, which make occasional trips. Steam schooners also at times take a cargo into Redwood Creek. The following is a statement of the business done in 1903, as furnished by the shippers:

| | Tons. |
|---|---|
| Building material received and shipped | 1,300 |
| Supplies for tannery received | 11,372 |
| Tannery products shipped | 1,118 |
| Salt shipped | 7,500 |
| Total | 21,290 |

## T T 3.

## IMPROVEMENT OF HARBOR AT SAN FRANCISCO, CALIFORNIA.

The work in this harbor contemplated the removal of Arch rock, the two Shag rocks, and Blossom rock, all to the depth of 30 feet below the level of the lower low tides. The work was placed under continuing contract in 1899 for Arch and Shag rocks and was completed in April, 1903. Contract for the removal of Blossom rock was made in November, 1902, and completed on December 28, 1903. This rock was removed by surface blasting and then dredging the broken rock into deep water alongside, at a cost of $49,228.64. The total cost of removing all the rocks to a depth of 30 feet was $316,529.68. As all the work for which appropriations were made and authorized has been completed, no further appropriations are necessary.

Assistant Engineer H. L. Demeritt was in charge of the work and rendered excellent service.

Acknowledgment is made to Capt. A. F. Rodgers, U. S. Coast and Geodetic Survey, for copies of tide-gauge readings while work was in progress.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $52, 230. 01 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 48, 759. 69 |
| July 1, 1904, balance unexpended | 3, 470. 32 |

### APPROPRIATIONS.

| | |
|---|---|
| March 3, 1899 | $100, 000 |
| June 6, 1900 | 170, 000 |
| March 3, 1903 | 50, 000 |
| Total | 320, 000 |

### CONTRACTS IN FORCE.

*Contract dated November 14, 1902, for removing Blossom Rock, San Francisco Bay, California, for $45,142.*

Name of contractor: Robert Wakefield.
Date of approval: November 26, 1902.
Work commenced: May 17, 1903.
Work completed: December 28, 1903.

### COMMERCIAL STATISTICS.

The tonnage of the vessels entered and cleared at the port of San Francisco during the calendar year 1903 was reported by the secretary of the San Francisco Merchants Exchange as 3,367,646 tons. The number of vessels entered during that period was 1,036, and the number cleared was 1,414. This only includes commercial vessels, and not the large number of United States and foreign government vessels which visit this port. There are also a number of large ferry boats which ply between San Francisco and other points on the bay, and carry much freight and enormous numbers of passengers. There is also a large fleet of small steam and sail boats carrying freight to the various landings on and adjacent to the bay.

## T T 4.

## IMPROVEMENT OF OAKLAND HARBOR, CALIFORNIA.

Report in detail as to depth and width of channel, with the project for improvement, are printed in the Annual Report of the Chief of Engineers for 1897, page 3327. The history of the work and further project for improvement are found in the Annual Report for 1901, page 3434.

During the fiscal year ending June 30, 1904, the sum of $115,105.48 has been expended. During the entire fiscal year dredging has been in progress in the harbor under continuing contract made in 1902 at the rate of 8.44 cents per cubic yard, place measurement.

The funds available are sufficient to complete all the work authorized by Congress in act of June 13, 1902. This act appropriated $100,000 and authorized continuing contracts to a limit of $250,000 to prosecute said project. The sundry civil act of March 3, 1903, appropriated $131,000 for continuing improvement, and the sundry civil act of April 28, 1904, appropriated $19,000 for continuing improvement in completion in contract limit, making a total of $250,000, as contemplated in the river and harbor act of June 13, 1902.

Special attention is invited to the language in the above act, viz:

> Improving Oakland Harbor, California, in accordance with report submitted in House Document Numbered Two hundred and sixty-two, Fifty-sixth Congress, second session, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to *prosecute said project*, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred and fifty thousand dollars, exclusive of the amounts herein and heretofore appropriated.

In House Document No. 262 therein referred to were plans and estimates for three alternate projects, estimated to cost, respectively, $646,293, $1,687,818, and $968,203. Congress failed to state which of the three projects the appropriation was made for, and as the limit authorized for expenditure by contracts, etc., was only $250,000, and the estimated cost of the smaller project was $646,293, it leaves the matter in an incomplete and uncertain state.

With the money appropriated and authorized continuing contracts were made for work common to all three of the projects, which will only give a 20-foot low-water channel depth 400 feet wide from San Francisco Bay to Channel street, Oakland, and 300 feet wide channels 20 feet deep to Webster street, 17 feet deep to tidal basin, 8 feet deep on north side of tidal basin, and 12 feet deep on south side of tidal basin, respectively. It will fail to give a 500-foot wide channel from deep water in San Francisco Bay to Fallon street, Oakland, and will also fail to give a 12-foot deep channel at low water on the north side of the tidal basin.

During the fiscal year ending June 30, 1904, a channel has been dredged from the 20-foot depth in San Francisco Bay into Oakland Harbor for a length of 5,500 feet, a width of 100 feet, and to a depth of 20 feet at low water. Material dredged from this section measured 309,247 cubic yards. Between Chestnut street and the west end of the tidal basin a channel has been dredged 5,250 feet long, 300 feet wide, and to a depth of 17 feet at low water, containing 512,583 cubic yards, and on the south side of the tidal basin a channel has been dredged measuring 3,700 feet in length, 300 feet in width, and to a depth of 12 feet at low tide, measuring 554,409 cubic yards, making a total excavated during the fiscal year ending June 30, 1904, of 1,376,239 cubic yards.

In the existing contract for dredging in this harbor a total volume of 1,573,239 cubic yards has thus far been removed, or about 60 per cent of the work contracted for has thus far been completed.

A very large part of the dredging thus far done has been in an exceedingly hard sandstone formation, which taxes the steel cutters of the dredge severely and makes the rate of progress necessarily slow.

The money appropriated and available is sufficient and somewhat in excess of the amount required to pay for the completion of the existing contract. If Congress, however, desires to complete even the smaller project submitted in December, 1900, printed in the Annual Report of the Chief of Engineers for 1901, page 3445, and estimated on page 3448 of above report to cost $646,293, then suitable provision for the completion of this or either of the other projects submitted in the same report which Congress sees fit to adopt should be made.

To continue to completion the smaller project it is estimated will cost $396,293, in addition to the $250,000 thus far appropriated. If this project be continued, then $180,000 can be advantageously expended in the fiscal year ending June 30, 1906.

The work has been in charge of Assistant Engineer L. J. Le Conte, who has been attentive to his duties.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $249,944.28 |
| Amount appropriated by sundry civil act approved April 28, 1904 | 19,000.00 |
| | 268,944.28 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 115,105.48 |
| July 1, 1904, balance unexpended | 153,838.80 |
| July 1, 1904, amount covered by uncompleted contracts | 110,419.13 |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| June 24, 1874 | $100,000 | July 13, 1892 | $150,000 |
| March 3, 1875 | 100,000 | August 18, 1894 | 100,000 |
| August 14, 1876 | 75,000 | June 3, 1896 | 20,000 |
| June 18, 1878 | 80,000 | June 4, 1897 | 200,000 |
| March 3, 1879 | 60,000 | July 1, 1898 | 133,000 |
| June 14, 1880 | 60,000 | March 3, 1899 | 133,000 |
| March 3, 1881 | 60,000 | June 6, 1900 | 180,000 |
| August 2, 1882 | 200,000 | June 13, 1902 | 100,000 |
| July 5, 1884 | 139,600 | March 3, 1903 | 131,000 |
| August 5, 1886 | 60,000 | April 28, 1904 | 19,000 |
| August 11, 1888 | 350,000 | | |
| September 19, 1890 | 250,000 | Total | 2,700,600 |

### CONTRACTS IN FORCE.

*Contract dated December 27, 1902, for dredging in Oakland Harbor, California.*

Rate: 8.44 cents per cubic yard.
Name of contractor: Warren H. Pomeroy.
Date of approval: January 8, 1903.
Work commenced: February 17, 1903.
Work completed: Still in progress.

### COMMERCIAL STATISTICS.

The following statements show the traffic by vessels and ferry boats which passed through the channel way between the jetties during the calendar year 1903.

The classified freight carried by merchant vessels during the year comprised:

| | Tons. |
|---|---|
| Coal, wood, coke, and oil | 164,000 |
| Hay, grain, flour, etc | 137,000 |
| Lumber | 250,000 |
| Building materials | 414,454 |
| Miscellaneous | 9,446 |
| Total | 974,900 |

It is impossible to classify the freight carried by the ferries, which includes all the overland freight carried out of San Francisco by the Southern Pacific Company, whose freight slip is situate at Peralta street, just inside the jetty channel. The total amount of freight carried by the ferries during the year 1903 amounted to 3,262,955 tons, an increase of 134,692 over that carried in 1902. The following statement shows the amounts landed at and shipped from the different ferry slips:

| | Tons. |
|---|---|
| Peralta street slip | 2,757,408 |
| Broadway slip | 258,528 |
| Narrow gauge slip | 247,019 |
| Total | 3,262,955 |

## T T 5.

## IMPROVEMENT OF SAN PABLO BAY, CALIFORNIA.

The project for the improvement of this bay requires a channel to be dredged 30 feet deep at low water, 300 feet wide and 27,000 feet long. Congress, by act of June 13, 1902, appropriated $100,000 and authorized continuing contracts to a limit of $331,000 for the completion of the work.

Contract was made with Rudolf Axman at the rate of 11.44 cents per cubic yard, place measurement, and approved in December, 1902. Work was commenced in February, 1902, and up to June 30, 1903, a dredger cut had been made about 2,000 feet long, varying in width from 100 to 120 feet, and to a depth of 30 feet at low water; and another cut about 2,500 feet long and 60 feet wide, but which was not completed to the full depth. The contractor stopped work in June, 1903, resumed October 28, and worked until December 24, 1903, on which date the contract was annulled for failure to comply with its terms.

In the work thus far done a cut was made about 8,000 feet long, varying from 60 to 120 feet in width, and generally to a depth of 30 to 31 feet below low-water level, removing approximately 196,000 cubic yards of material, of which 165,053 cubic yards were above the 30-foot plane and of which 31,000 cubic yards were between the 30 and 31-foot planes below low water. The quantities removed during the ten months of the existence of the contract were less than 20 per cent of its requirements.

The amount of dredging done under the contract in the fiscal year ending June 30, 1904, was approximately 50,000 cubic yards.

The work was readvertised and bids opened on March 2, 1904. For good and sufficient reasons all bids were rejected. The work was again readvertised and bids opened on May 24, 1904. Contract was made with the North American Dredging Company of San Francisco, Cal., in June, 1904, at the rate of 14.48 cents per cubic yard, place measurement. This contract is now awaiting approval.

About 20 feet at low tide can be carried over the shoalest part of the bar.

Congress has thus far appropriated $300,000 for the work. For its completion $81,000 is yet required.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $297,879.84 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 3,081.44 |
| July 1, 1904, balance unexpended | 294,798.40 |
| July 1, 1904, amount covered by uncompleted contracts | 330,868.00 |
| Amount (estimated) required for completion of existing project | 81,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 81,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| | |
|---|---|
| June 13, 1902 | $100,000 |
| March 3, 1903 | 200,000 |
| Total | 300,000 |

### CONTRACTS IN FORCE.

*Contract dated November 21, 1902, for dredging in San Pablo Bay, California.*

Rate: 11.44 cents per cubic yard.
Name of contractor: Rudolf Axman.
Date of approval: December 27, 1902.
Work required to be commenced: March 4, 1903.
Work required to be completed: July 4, 1905.
Contract annulled: December 24, 1903.

---

## T T 6.

### IMPROVEMENT OF SAN JOAQUIN RIVER, CALIFORNIA.

A description of this river, its original condition, and plan for its improvement are printed in the Annual Report of the Chief of Engineers for 1896, page 3189.

In February, 1904, owing to heavy and prolonged rains, the Calaveras River, which empties into the San Joaquin through Mormon and Stockton sloughs, rose rapidly and caused a serious bar to form to such a height in and across the Stockton channel that for several days steamboats could not drag over it even in the highest stages of the river. A hasty examination was made, and it was estimated that about 71,000 cubic yards of fill had occurred. Authority was obtained by telegraph to advertise for bids and make emergency contract for the removal of this obstruction. Contract was made with Marshall C. Harris, the lowest bidder, for its removal at 7½ cents per cubic yard, place measurement. Dredging was commenced on March 21 and completed in June, 1904. This produced a channel from 7 to 9 feet in depth at low water and from 50 to 100 feet in width. While dredging was in progress the freshet continued, and at times the bar continued to grow faster than the dredge could remove the material. A total of 123,400 cubic yards of material was dredged and placed on shore. The money available was not sufficient to complete a channel to the full depth of 9 feet below low water for a width of 100 feet as was contemplated when the contract was made.

The total amount expended during the fiscal year ending June 30, 1904, for dredging was $19,074.86.

At present the levees and shores of Stockton channel are piled so high with deposits of dredged material that no further storage ground can here be obtained, and any future material dredged from this locality will have to be deposited on the banks of Mormon channel, which will require a pump dredger, and the spoil will have to be transported through pipes for a maximum distance of 2 miles. This will cause a material increase in the cost for dredging per cubic yard.

From the emergency river and harbor act of 1904 an allotment of $35,170 has been made for continuing improvement of this river, which includes the repairs to the weir at Lairds Slough, which was damaged some time during the calendar year 1903.

As bars form annually they must be removed or navigation must cease. On account of the increased expense, due to long carriage for dredging, it is estimated that $35,000 will be required and can be advantageously expended on this river for the fiscal year ending June 30, 1906.

## *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $21,236.23 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | 35,170.00 |
| | 56,406.23 |
| June 30, 1904, amount expended during the fiscal year, for works of improvement | 19,074.86 |
| July 1, 1904, balance unexpended | 37,331.37 |
| Amount (estimated) required for completion of existing project | Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 35,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

### APPROPRIATIONS.

| | |
|---|---|
| August 14, 1876 | $20,000 |
| June 14, 1880 | 20,000 |
| March 3, 1881 | 40,000 |
| August 2, 1882 | 40,000 |
| July 5, 1884 | 20,000 |
| August 5, 1886 | 18,750 |
| August 11, 1888 | 25,000 |
| September 19, 1890 | 75,000 |
| July 13, 1892 | 65,000 |
| August 18, 1894 | $50,000 |
| June 3, 1896 | 57,750 |
| March 3, 1899 | 20,000 |
| June 13, 1902 | 18,000 |
| Allotted from act of April 28, 1904 | 35,170 |
| Total | 504,670 |

### CONTRACTS IN FORCE.

*Contract dated April 23, 1903, for dredging in Stockton channel, San Joaquin River, California.*

Name of contractor: Bay and River Dredging Company.
Work commenced: April 29, 1903.
Work completed: July 1, 1903.
Rate: 8.5 cents per cubic yard.
Total cost: $12,040.68.

*Contract dated March 9, 1904, for dredging in Stockton channel, San Joaquin River, California.*

Name of contractor: Marshall C. Harris.
Date of approval: Emergency contract.
Work commenced: March 21, 1904.
Work completed: June 13, 1904.
Rate: 7.5 cents per cubic yard.
Total cost: $9,254.99.

### COMMERCIAL STATISTICS.

The following is a statement of the freight carried on the San Joaquin River during the year 1903 by the boats of the Union Transportation Company, which run regularly between San Francisco and Stockton, and of the California Navigation and Improvement Company, which run regularly between San Francisco and Stockton and make occasional trips during the high water season into the Upper San Joaquin River.

| General freight: | Tons. |
|---|---|
| Lower San Joaquin River | 366,038 |
| Upper San Joaquin River | 10,845 |

A number of scow schooners also carry freight on the Lower San Joaquin River, but it has been impossible to obtain any statement of the amount.

## T T 7.

### RECTIFICATION OF STOCKTON AND MORMON CHANNELS, CALIFORNIA.

The river and harbor act of June 13, 1902, provided for improvement of this locality by a dam and canal to divert the waters of Mormon Slough into the Calaveras River, based on a project estimated to cost $255,016, printed in the Annual Report of the Chief of Engineers for 1899, page 3189. The act referred to appropriated $50,000 and authorized contracts to a limit of $225,000 for the completion of the work. An aggregate of $175,000 has now been appropriated by Congress for the work. Among the provisions in the act of 1902 was one that "the city of Stockton or the State of California shall first furnish to the United States the right of way for said canal." The legislature of the State of California appropriated $60,000 for acquiring this right of way, and the State commissioner of public works is now endeavoring to obtain the necessary property. No work on the project has yet been done.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $100,000.00 |
| Amount appropriated by sundry civil act approved April 28, 1904 | 75,000.00 |
| July 1, 1904, balance unexpended | 175,000.00 |
| Amount (estimated) required for completion of existing project | 49,316.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 49,316.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| | |
|---|---|
| June 13, 1902 | $50,000 |
| March 3, 1903 | 50,000 |
| April 28, 1904 | 75,000 |
| Total | 175,000 |

## T T 8.

### IMPROVEMENT OF MOKELUMNE RIVER, CALIFORNIA.

A description of this stream, with project for improvement, work done, and commerce carried, is printed in the Annual Report of the Chief of Engineers for 1899, page 3168.

During the fiscal year ending June 30, 1904, no work has been done on the river, nor has any been done since 1896. A portion of the unexpended balance on hand June 30, 1903, has been expended in repairs to the Government snag boat *Seizer*.

In the past year two public hearings have been held in consequence of a complaint that the Benson Ferry bridge, about 4½ miles above New Hope Landing, was an unreasonable obstruction to navigation. It is learned that the board of supervisors of San Joaquin County have advertised this bridge for sale, with a requirement that it be removed a certain number of days after the confirmation of the sale.

It is also learned that the State of California has allotted $10,000 of its State funds for the improvement of the river above the Benson Ferry bridge, to be used after this bridge shall have been removed.

Occasional snagging on the river and cutting down overhanging trees on its banks is necessary for the maintenance of navigation. It is estimated that $2,500 can be profitably expended for this purpose in the fiscal year ending June 30, 1906.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $888.34 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 524.10 |
| July 1, 1904, balance unexpended | 364.24 |

| | |
|---|---|
| Amount (estimated) required for completion of existing project | Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 2,500.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| | |
|---|---|
| July 5, 1884 | $8,500 |
| August 5, 1886 | 2,500 |
| August 11, 1888 | 2,000 |
| July 13, 1892 | 2,500 |
| August 18, 1894 | 2,500 |
| Total | 18,000 |

COMMERCIAL STATISTICS.

The commerce of the Mokelumne River during the year 1903 was carried on two stern-wheel steamers, each of about 400 tons gross register, which make daily trips to New Hope Landing. The amount of freight reported to have been carried during the year 1903 was 41,411 tons. Scow schooners are reported to have also brought a considerable amount of grain out of this river during the year, but it was impossible to obtain even an estimate of the amount.

*Comparative statement of grain and general freight.*

| | Tons. | | Tons. |
|---|---|---|---|
| 1885 | 42,000 | 1900 | 86,989 |
| 1892 | 44,241 | 1901 | 81,701 |
| 1893 | 47,000 | 1902 | 43,299 |
| 1898 | 52,771 | 1903 | 41,411 |

## T T 9.

## IMPROVEMENT OF SACRAMENTO AND FEATHER RIVERS, CALIFORNIA.

### REPORT OF BOARD OF ENGINEERS.

During the fiscal year ending June 30, 1904, the Sacramento River had an unusual flood which in February, 1904, caused a break or crevasse in the levee on the Edwards place, situated on the left bank of the river about 3 miles below Sacramento. No Government funds could be used for its closure. The State reclamation district took the matter in hand and made contracts for closing the break; and though work was commenced immediately, the crevasse was not completely closed until the early part of June, 1904, at a cost reported to be in excess of $100,000. During this time the breach had widened to over 1,400 feet, and the depth in places exceeded 40 feet. The immense volume of water passing through the break is said to have inundated over 100,000 acres of land, passed down into the American basin via the Mokelumne River into the San Joaquin, causing another break in the levees at Bouldin Island near the mouth of the Mokelumne River. The damage on this island alone, which was largely planted in asparagus, is said to exceed $500,000. The latter break is not yet closed, although upward of $60,000 has been expended in the attempt.

In March, 1904, the board of trustees of Sacramento wired to some of the Senators and Representatives from California urging that the floods had produced a condition which threatened the navigability of the river, and asked that immediate steps be taken to protect the river against further impairment. This was referred to the War Department, suggesting that in such cases an emergency appropriation might be made by Congress, etc., and asking the attention of the War Department to aid in securing such appropriation. The matter was referred to and investigated by one of the members of our Board. It was found and reported that navigation up to that time had not been interfered with, nor has it been since; and if there should be interference in future, the funds available for the lower river would probably remedy the difficulty.

The river and harbor act of 1899 appropriated $30,000 for the improvement of the lower river below Sacramento and authorized continuing contracts to the limit of $280,000 for such material and work as may be necessary to carry out the revised project submitted by the Board on October 11, 1898, and which is printed in the Annual Report of the Chief of Engineers for 1899, page 3173. On June 6, 1900, Congress, in the sundry civil act, appropriated $60,000 for the improvement of the river below Sacramento, making a total of $90,000 for the purpose stated in the act of 1899. The depth of water required by the project, viz, 7 feet at low water, was obtained by an expenditure of a little more than $37,000, which leaves a balance of about $53,000 yet available, together with authority to make continuing contracts to the limit of $280,000.

The contracts thus far made for the work done were not continuing, but were always well within the limits of the amounts appropriated and available, and were based on unit prices for work at special shoals as might be directed; so that the experience gained in the location, length, and spacing of the construction works at any one shoal could be taken advantage of in similar work at the next shoal below. By this means the work has been economically and effectively done, at a cost of only about 13 per cent of the estimate. The depths obtained have been well maintained.

The river in many places above Sacramento and below Red Bluff, the head of navigation, is in very bad condition. Owing to lack of funds, the snag boat could not be sent out in 1903 to clear the river of snags. As snagging is the most important work in the interests of navigation on the whole river, and as funds appropriated for the lower river can not be used on the upper, the Board not only renews its recommendation made in the last annual report, that the unexpended balance appropriated for the lower river below Sacramento be made available for the whole river, but, in addition, recommends that the authorization in the act of March 3, 1899, be amended so as to make it applicable to the whole river below the head of navigation.

The small balance available for the Sacramento and Feather rivers on June 30, 1903, had to be used for the repair of the snag boat. This was done by contract made on October 28, 1903. The work was completed in April, 1904, at a cost of $10,139.08.

The necessity for an annual appropriation for snagging the upper river is so urgent that the Board renews its recommendation, made in the last annual report, that some legislation be asked for the purpose of securing uninterrupted work of operating snag boats in the Sacramento River for removing snags, wrecks, and other obstructions, and authorizing the Secretary of War, upon the application of the Chief of Engineers, to draw a warrant from time to time upon the Secretary of the Treasury for such funds as may be necessary to do such work, not to exceed $25,000 per year, and that an itemized statement of said expenses accompany the Annual Report of the Chief of Engineers.

Besides the repairs to the snag boat, the only other work done on the river during the past year was repairing a wing dam just above Sacramento. This was refilled with brush, weighted with bags of sand, and all securely wired to the piles. The total cost of this work, which was done by hired labor, was $410.10.

The only work required at present, in sight, on the lower river, is the removal of some snags which have lodged near Heacock's Shoal, and for which it has been construed that the present appropriation for improving the Sacramento River below Sacramento is inapplicable, as snagging was inadvertently omitted in the project submitted by the Board in 1897–98. It is necessary for the maintenance of navigation to remove snags wherever found in the river. An allotment of $22,000 made from the emergency river and harbor act of April, 1904, will, however, remedy this difficulty for the present season.

## *Money statements.*

### SACRAMENTO AND FEATHER RIVERS, CALIFORNIA.

| | |
|---|---|
| July 1, 1903, balance unexpended | $10,519.64 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | 22,000.00 |
| | 32,519.64 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 10,511.08 |
| July 1, 1904, balance unexpended | 22,008.56 |
| Amount (estimated) required for completion of existing project | Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 25,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

### SACRAMENTO RIVER BELOW SACRAMENTO, CAL.

| | |
|---|---|
| July 1, 1903, balance unexpended | [a]$53,348.91 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 458.17 |
| July 1, 1904, balance unexpended | 52,890.74 |

---

### APPROPRIATIONS.

*Sacramento and Feather rivers, California.*

| | | | |
|---|---|---|---|
| March 3, 1875 | $15,000.00 | July 13, 1892 | $150,000.00 |
| June 18, 1878 | 15,000.00 | August 18, 1894 | 115,000.00 |
| March 3, 1879 | 20,000.00 | June 13, 1902 | 25,000.00 |
| June 14, 1880 | 45,000.00 | Allotted from act of April 28, 1904 | 22,000.00 |
| March 3, 1881 | 60,000.00 | Received from sales | 73.80 |
| August 2, 1882 | 250,000.00 | | |
| July 5, 1884 | 40,000.00 | Total | 807,073.80 |
| August 11, 1888 | 20,000.00 | | |
| September 19, 1890 | 30,000.00 | | |

*Sacramento River, California.*

| | |
|---|---|
| March 3, 1899 | $30,000.00 |
| June 6, 1900 | 60,000.00 |
| Total | 90,000.00 |

---

### CONTRACT IN FORCE.

*Contract dated October 28, 1902, for repairing U. S. snag boat Seizer.*

Name of contractor: Gratto & Reimers.
Date of approval: November 19, 1903.
Work commenced: December 3, 1903.
Work completed: April 20, 1904.
Total cost: $10,139.08.

---

[a] Erroneously reported last year as $53,748.91.

COMMERCIAL STATISTICS.

| | Tons. |
|---|---|
| Lower Sacramento River, below Sacramento: | |
| By the boats of the Sacramento Transportation Company | 99,845 |
| By the boats of the Southern Pacific Company | 139,091 |
| By the boats of the California Transportation Company | 56,333 |
| Upper Sacramento River, above Sacramento: | |
| From San Francisco and Sacramento to upriver points: | |
| Lumber | 8,400 |
| General merchandise | 9,925 |
| From upriver points to San Francisco: | |
| Hay | 920 |
| Broom corn | 375 |
| Wool | 440 |
| Dried fruit | 294 |
| Miscellaneous | 2,510 |
| From upriver points to Sacramento: | |
| Wood | 2,128 |
| Corn | 842 |
| Potatoes | 1,784 |
| Grain | 1,067 |
| Hogs and cattle | 970 |
| Miscellaneous | 925 |
| Grain shipments from upriver points to San Francisco and Port Costa: | |
| From Knights Landing to and including Colusa | 23,368 |
| From above Colusa to and including Butte City | 17,742 |
| From above Butte City to and including Jacinto | 7,781 |
| From above Jacinto to and including Chico Landing | 5,868 |
| From above Chico Landing to and including Red Bluff | 3,116 |
| Total tonnage of the Sacramento River for 1903 | 383,724 |

## T T 10.

## IMPROVEMENT OF PETALUMA CREEK AND NAPA RIVER, CALIFORNIA.

### (A) PETALUMA CREEK.

A description of this creek, its original condition, project for improvement, and work done is printed in the Annual Report of the Chief of Engineers for 1896, page 3205.

No work other than making a resurvey has been done during the fiscal year ending June 30, 1904. The channel depths obtained can not be maintained without periodical dredging. Contract for redredging the channel at 8 cents per cubic yard was approved June 15, 1904.

No work has been done on this creek since 1900, and the dredging which is now under contract will probably produce a channel which, under ordinary circumstances and conditions, should be maintained for about two years. Hence no additional funds are required for the fiscal year ending June 30, 1906.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $3,269.93 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 96.60 |
| July 1, 1904, balance unexpended | 3,173.33 |
| July 1, 1904, amount covered by uncompleted contracts | 3,000.00 |
| Amount (estimated) required for completion of existing project | Indeterminate. |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| June 14, 1880 | $8,000 | August 18, 1894 | $15,000 |
| March 3, 1881 | 8,000 | March 3, 1899 | 4,000 |
| August 2, 1882 | 14,000 | June 13, 1902 | 3,000 |
| August 11, 1888 | 2,000 | | |
| September 19, 1890 | 4,000 | Total | 68,000 |
| July 13, 1892 | 10,000 | | |

### COMMERCIAL STATISTICS.

The commerce of Petaluma Creek is carried on one steamer, the *Gold*, 334 tons, which makes daily trips between San Francisco and Petaluma, the head of navigation. A large amount of the heavier freight is also carried by scow schooners, which make daily trips into the creek, but no statement, that is better than a wild guess, can be obtained of the amount of freight they carry.

The following is a statement of the freight carried by the steamer *Gold* during the year 1903:

| | Tons. |
|---|---|
| Eggs | 806 |
| Fruit | 2,325 |
| Horses and cattle | 1,565 |
| General merchandise | 40,169 |
| Total | 44,865 |

## (B) NAPA RIVER.

A description of this river, its condition, plans for improvement, and results obtained are printed in the Annual Report of the Chief of Engineers for 1896, page 3177.

Preliminary examination of the river was made in August, 1902. No work other than surveying for contract work has been done on the river during the fiscal year ending June 30, 1904.

Contract was made in June, 1904, at 20 cents per cubic yard, place measurement, for dredging some of the gravel bars in the river to a depth of 4 feet below low-water level. The river is subject to freshets, and dredged channels are not self-maintaining, making occasional dredging necessary.

It is estimated that $3,000 can be profitably expended in the fiscal year ending June 30, 1906.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $3,406.97 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 113.34 |
| July 1, 1904, balance unexpended | 3,293.63 |
| July 1, 1904, amount covered by uncompleted contracts | 3,000.00 |
| Amount (estimated) required for completion of existing project | Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 3,000.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

### APPROPRIATIONS.

| | |
|---|---|
| August 12, 1888 | $7,500 |
| September 19, 1890 | 10,000 |
| August 18, 1894 | 4,000 |
| June 3, 1896 | 4,000 |
| June 13, 1902 | 3,000 |
| Total | 28,500 |

### CONTRACT IN FORCE.

*Contract dated May 31, 1904, for dredging in Petaluma Creek and Napa River, California.*

Name of contractor: Pacific Reclamation Company.
Date of approval: June 15, 1904.
Work to be commenced: July 12, 1904.
Work to be completed: October 31, 1904.

### COMMERCIAL STATISTICS.

The commerce of Napa River in 1903 was carried on two small stern-wheel steamers, which make trips between San Francisco and Napa on alternate days, thus providing a daily service. The amount of freight carried by these boats is believed to have been about 70,000 tons, but a statement of the amount, which was promised, has not been received in time to be included in this report. Much of the heavier freight on this stream is carried by scow schooners, which run into the river at irregular intervals, but no statement of the amount of the freight carried can be obtained.

## T T 11.

## IMPROVEMENT OF HUMBOLDT HARBOR AND BAY, CALIFORNIA.

The history of this improvement is printed in the Annual Report of the Chief of Engineers for 1900, page 4237.

All work contemplated for the improvement of the entrance as well as inside the bay has been completed. No work has been done or required at this locality except to establish some monuments and run a few base lines with a view to reestablishing harbor lines to replace those adopted some years since. No authentic report of any changes in the depth or direction of the channel at the entrance has been received. The depth in the dredged channel in front of the town of Eureka has been well maintained.

No further funds are required at present.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $11,605.97 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 1,132.27 |
| July 1, 1904, balance unexpended | 10,473.70 |

### APPROPRIATIONS.

| | | | |
|---|---|---|---|
| March 2, 1881 | $40,000 | March 2, 1895 | $225,000 |
| August 2, 1882 | 40,000 | June 11, 1896 | 225,000 |
| July 5, 1884 | 62,500 | June 4, 1897 | 350,000 |
| August 5, 1886 | 75,000 | July 1, 1898 | 100,000 |
| August 11, 1888 | 125,000 | March 3, 1899 | 50,000 |
| September 19, 1890 | 80,000 | March 3, 1899 | 143,115 |
| July 13, 1892 | 150,000 | | |
| March 3, 1893 | 522,000 | Total | 2,187,615 |

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### COMMERCIAL STATISTICS.

The following statement of the commerce of Humboldt Bay, California, was collected and supplied by Mr. George A. Kellogg, secretary of the Humboldt Chamber of Commerce at Eureka, Cal. It gives the amount carried during the year 1903, and shows a general increase in the commerce of the bay.

| Articles. | Tons. | Value. |
|---|---|---|
| EXPORTS. | | |
| Lumber | 415,989 | $4,816,600 |
| Produce | 13,493 | 2,015,990 |
| Miscellaneous | 6,571 | 414,665 |
| Total | 436,053 | 7,247,255 |
| IMPORTS. | | |
| General merchandise | 75,638 | 3,993,755 |
| Iron | 8,560 | 299,600 |
| Coal | 5,821 | 41,546 |
| Hay | 4,369 | 52,428 |
| Wool, scoured | 110 | 77,000 |
| Miscellaneous | 3,261 | 163,050 |
| Total | 97,759 | 4,627,379 |

*Movement of vessels, tonnage, and passengers.*

| | Steam vessels. | Sail vessels. | Total vessels. | Tonnage. | Passengers. |
|---|---|---|---|---|---|
| Arrived | 575 | 174 | 749 | 355,775 | 16,274 |
| Departed | 579 | 180 | 759 | 360,525 | 12,631 |
| Total | 1,154 | 354 | 1,508 | 716,300 | 28,905 |

## T T 12.

## IMPROVEMENT OF PEARL HARBOR, TERRITORY OF HAWAII.

A description of this harbor and the approved project for improvement was printed in the Annual Report of the Chief of Engineers for 1901, page 2433.

Contract was made in 1901 for dredging a channel over the bar at the entrance to the harbor 30 feet deep at low water and 200 feet bottom width, requiring the removal of 200,625 cubic yards of material, principally coral sand. The work was completed in August, 1903, at a cost of $99,323.62. The depths and widths have been well maintained.

The work was in charge of Mr. Laurence Thompson, junior engineer inspector.

There is no commerce yet in the harbor. Naval officers claim that inside the bar and in the approaches to the harbor proper the curvature of the channel is too sharp for the safe navigation of large naval vessels. No examination for remedying this has yet been authorized by Congress.

The work has been completed in accordance with the project and within the limits of the appropriation. No further funds are required.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $28,552.62 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 27,876.24 |
| July 1, 1904, balance unexpended | 676.38 |

APPROPRIATIONS.

| | |
|---|---|
| March 3, 1899 | $100,000 |

CONTRACT IN FORCE.

*Contract dated July 16, 1901, for dredging channel through Pearl Harbor Bar, Hawaii.*

Name of contractor: Clark & Henery.
Rate: 44.5 cents per cubic yard.
Date of approval: July 25, 1901.
Work commenced: February 21, 1902.
Work completed: August 3, 1903.

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## T T 13.

## PRELIMINARY EXAMINATION OF BELVEDERE HARBOR, SAN FRANCISCO BAY, CALIFORNIA.

[Printed in House Doc. No. 246, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a report, dated February 26, 1903, by Lieut. Col. W. H. Heuer, Corps of Engineers, on preliminary examination of Belvedere Harbor, in San Francisco Bay, California, ordered by the river and harbor act approved June 13, 1902. In the opinion of Lieutenant-Colonel Heuer the locality is not worthy of improvement by the General Government.

This report and statements from interested parties have been considered by the Board of Engineers for Rivers and Harbors, in accordance with the provisions of sections 3 and 14 of the above-mentioned act, and the Board states in its report, dated April 21, 1903, that it is not desirable for the United States to undertake the improvement.

In this conclusion I concur.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

## REPORT OF LIEUT. COL. W. H. HEUER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*San Francisco, Cal., February 26, 1903.*

GENERAL: In accordance with the requirements of the river and harbor act of June 13, 1902, I have the honor to submit the following report of a preliminary examination of Belvedere Harbor, in San Francisco Bay, California:

This small harbor is located in San Francisco Bay, about 3 statute miles to the northward of the Golden Gate, or entrance to the bay. Belvedere Harbor is an indentation or cove in the shore line; has a breadth of three-fourths of 1 statute mile, over which the depth at low water varies from 1 to 5 feet, and is right on the edge of Racoon Strait, which has a width of about half a mile, a depth varying from 10 to 30 fathoms, and an exceedingly rapid current.

Peninsula Point is the west point of entrance to this strait, and is at the southerly end of Belvedere Harbor. Peninsula Point is a rocky headland of about 150 feet in height and has a depth of 7 fathoms of water close up to its edge. Two hundred yards off this point, in Raccoon Strait, the depth is 39 fathoms. At the northern end of Belvedere Harbor, and three-fourths of a mile distant from Peninsula Point, is Tiburon Point, off which the water is 15 fathoms deep. On the line joining these two points the water varies in depth from 10 to 17 fathoms, and immediately to the westward of this line, and between said line and the shore, is what is known as Belvedere Harbor, throughout which the water suddenly shoals to a depth of 2 to 6 feet, and which is a rendezvous or harbor for very small pleasure craft and yachts. At Tiburon Point a railroad about 137 miles in length runs into the interior of the State, and a ferry connects same with the city of San Francisco, about 6 miles distant.

Belvedere, from which the harbor takes its name, is a rocky peninsula, sometimes called an island, a little more than a mile in length, about one-third of a mile in width, with a crest elevation from 150 feet to a little more than 300 feet in height above sea level, and is dotted with 70 to 80 cottages as residence sites. The summer population of Belvedere is 500 to 600 persons; in winter it is somewhat less. Tiburon has a fixed population of about 250 persons. Belvedere Harbor connects with a small back bay covering an area of about 200 acres, which at low tide is bare and at high tide is covered with water to a depth of 4 to 5 feet. This small bay is used as winter quarters for the small pleasure craft and house boats which in summer are used in Belvedere Harbor.

Near and to the west of Point Tiburon are three slips or piers used by the railroad company at which the ferry boats and scow schooners load and discharge freight and passengers; in fact, it is the only place in the harbor at which commerce is carried on. The little harbor of Belvedere is perfectly protected against any winds from the north, northwest, west, or southwest, but is exposed to gales from the southeast. Angel Island is about 1 mile to the eastward of the harbor, with the very deep water and rapid current of Raccoon Strait flowing between the island and harbor.

Belvedere furnishes nothing for export. It is simply a site for residences. Tiburon is of some importance in consequence of its being a railroad terminus, at which some 190,000 tons of freight were handled in the past year, of which it is estimated 168,000 tons were carried by ferry.

The Coast Survey charts of the present time, as compared with those of earlier date, show no material shoaling in Belvedere Harbor. Some of the Belvedere and Tiburon residents say it is shoaler than it was years ago.

The only way in which the harbor can be improved is by dredging. As the area to be dredged covers about three-eighths of a square mile, each foot of increased depth means the removal of about 387,200 cubic yards of material. Dumping ground for the deposit of this material can be found in the back bay. The owners of yachts have not stated to what increased depth they desire the harbor made; but assuming that a depth of 10 feet would be sufficient, this would require the removal of 3,000,000 cubic yards of material.

If the harbor were deepened it would make it better and safer for pleasure craft. It is not believed that it would materially increase commerce or reduce freight rates and insurance, and if dredged it is improbable that the increased depth would be maintained without periodical redredging. It is believed from the examination and investigation made that the expense of improving and maintaining this harbor would be far in excess of the advantages to be gained to commerce, and therefore, at present, I consider Belvedere Harbor as unworthy of improvement.

Of the 47 small power boats referred to in Schedule No. 1,[a] only 2 are large enough to be on the registered list of vessels in the United States; and of the pleasure boats mentioned in Schedule No. 2,[a] 17 are schooners, 23 are yawls, 80 are sloops, and 3 are launches. A statement[a] by well-known citizens constituting a committee on Belvedere Harbor improvement is herewith, and a photograph[a] of Belvedere Harbor, showing numerous pleasure craft anchored there in summer, is inclosed.

Respectfully submitted.

W. H. HEUER,
*Lieut. Col., Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*March 10, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 21, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer and a statement submitted by a committee of interested citizens.

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[a] Not printed.

Belvedere Harbor is used principally as a haven for pleasure craft. Commercial piers are maintained at Point Tiburon, near the entrance to the harbor, but these piers are within a few hundred yards of the deep water of Raccoon Strait. Any general improvement of the harbor would involve dredging over the entire area designed for anchorage purposes, and it could not be expected that the deepening would be permanent.

The Board is of opinion that commercial benefits would be incommensurate with the cost of improvement, and that it is not desirable that the United States should undertake the improvement of Belvedere Harbor, in San Francisco Bay, California.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

## T T 14.

### PRELIMINARY EXAMINATION OF NAPA RIVER, CALIFORNIA, ABOVE MARE ISLAND NAVY-YARD.

[Printed in House Doc. No. 178, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith a report dated August 21, 1902, by Lieut. Col. W. H. Heuer, Corps of Engineers, on preliminary examination of Napa River, California, with a view to straightening the channel in the portion above Mare Island Navy-Yard, ordered by the river and harbor act approved June 13, 1902.

This stream is now being improved by the United States under a project for dredging the bars between Carrs Bend and Vernon Mills, in the immediate vicinity of Napa, cutting off projecting points of land so as to obtain a channel 75 feet wide and 4 feet deep at mean low water, and removing obstructions such as snags, logs, etc.

Lieutenant-Colonel Heuer considers that it is unnecessary to materially straighten the river, but that it is advisable to continue work as heretofore in accordance with the approved project, and this opinion is concurred in by the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act, and by me.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

HON. ELIHU ROOT,
*Secretary of War.*

## REPORT OF LIEUT. COL. W. H. HEUER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*San Francisco, Cal., August 21, 1902.*

GENERAL: In compliance with instructions from your office and the requirements of the river and harbor act of June 13, 1902, I have the honor to submit the following report on an examination of Napa River, California, with a view of straightening the channel in the portion above Mare Island Navy-Yard:

The examination was made on August 19, 1902.

Napa Creek, or River, is navigable up to the city of Napa, which is about 16 miles distant via the water route above Mare Island Navy-Yard. Hence, all of the Napa River is *above* Mare Island Navy-Yard.

Its drainage area is between 300 and 400 square miles; the State engineer gives it as 292 square miles above the town of Napa.

During the summer and autumn months this river is mainly a tidal stream. The ordinary range of the tides is about 5 feet. The spring tides reach a height of 7 feet. In the dry season at low tide at Napa the width of water surface is about 50 feet; at high tide the width between banks is from 100 to 160 feet. The width gradually increases toward the mouth, where it is from three-fourths to 1 mile in width.

In the rainy season the river is subject to freshets, which bring down trees, sand, and gravel, which form obstructions to navigation, and which are removed when appropriations are available, as contemplated in the approved project for the improvement and maintenance of navigation on this stream.

The tidal influence is all that makes this river navigable as far up as Napa. The two steamboats and the few sailing vessels (scow schooners) that use the river can use only the 3 or 4 miles of river immediately below Napa during high or medium stages of the tide. The distance from San Francisco to Napa by water is about 40 miles, of which about 36 miles is always good, deep, navigable water. The 4 miles of interrupted navigation is due to shoal water, narrow river, and excessive curvature. The banks are generally quite stable, and from 2 to 5 feet above ordinary high-tide level. During freshets the banks in places are inundated.

There are but three landings on the river below Napa—one at the tannery, which is just below the lower end of the town; the next at Stanley's ranch, some three miles below; and the last at Cuttings Landing, which is about a mile below the Stanley ranch.

A survey of the river was made under the direction of Colonel Mendell in 1884. A full description of the river, its commercial importance, the nature of the obstructions, with a project and estimate for its improvement, was made in 1885, and is printed in the Annual Report of the Chief of Engineers for 1885, Part 3, page 2343.

In this report it is stated:

> In alignment the channel is fairly convenient. There are, however, two bends, Jacks and Carrs bends, which are liable to cause some delay to vessels passing. The cost of making a new channel at the upper or Jacks bend is thought to be out of proportion to the advantage that would result. The case is different in some degree at Carrs bend. A better alignment can be made here by opening a new channel through a low point standing at about the level of high-water mark. A convenient channel 150 feet wide and 4 feet deep can be made by dredging 9,500 cubic yards,

The two bends above referred to are now in essentially the same condition as when reported in 1885. At Jacks bend the river is 170 feet wide and nearly forms a loop. The sharpest part of the curve has a radius about 150 feet in length. At Carrs bend the river is 190 feet wide, the curve is sharper than 90 degrees, and the radius is about 225 feet in length.

Cutting off of the point at Carrs bend was part of the project submitted by Colonel Mendell, but the estimate for the whole river improvement made at that time was $27,000, whereas the total amount appropriated up to 1902 was but $25,500, of which a very considerable portion has been spent for maintenance, so that the money available has never been sufficient to complete the project as outlined. However, boats have managed to pass Carrs bend without unusual detention.

Owing to the increased value of land in that vicinity, due to its high state of cultivation, the cost of purchase of the land, as well as that of dredging a suitable channel across the point, would have now to be considered, and would increase the cost of the project by probably $30,000, as it would involve the purchase of four acres and the cutting of 64,000 cubic yards of material.

The report of 1885 gave Napa a population of 4,000 to 5,000 people, and the commerce of the river at a little more than 64,000 tons. The last census fixes the population of Napa at a little more than 4,000 persons, and the tonnage of 1901 was 108,526 tons.

The steamboats are now larger than those of 1885, but make the same number of trips per month, and the time of a one-way trip is generally five to six hours. If this cut-off were made, it would probably not make more than five minutes' difference in the time of a trip, would not reduce the freight rates, and the benefit resulting therefrom would accrue to the owners of the two steamboats and would be measured by the cost of the fuel consumed, say approximately $18 in a year.

The steamboats using the river carry all the freight that offers, and charge about $1.50 per ton for the 40 miles of carriage.

The straightening of the channel above the navy-yard would benefit so few people, and be of such little aid to navigation or commerce, as to be incommensurate with the expense which it would incur.

For the reasons stated, I believe it unnecessary to materially straighten the river, but consider it advisable to continue work as heretofore in accordance with the approved project, which is to dredge bars between Carrs Bend and the head of navigation and to cut off projecting points, with a view to maintaining a channel 75 feet wide and 4 feet deep at low water, and to remove all snags, logs, etc., interfering with navigation.

Respectfully submitted.

W. H. Heuer,
*Lieut. Col., Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

[First indorsement.]

Office Chief of Engineers, U. S. Army,
*August 28, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of

Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

A. Mackenzie,
*Acting Chief of Engineers.*

[Second indorsement.[

Board of Engineers for Rivers and Harbors,
*Washington, D. C., February 24, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer.

The approved project for this river consists in dredging the bars between Carrs Bend and Vernon Mills, in the immediate vicinity of Napa City, cutting off projecting points of land so as to obtain a channel 75 feet wide and 4 feet deep at mean low water, and removing obstructions such as snags, logs, etc.

The Board concurs in the opinion of the district officer that it is not necessary to straighten the river materially, but that it is desirable for the United States to continue its improvement in accordance with the approved project.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

## T T 15.

## MODIFICATION OF HARBOR LINES ON THE EASTERLY SIDE OF MARE ISLAND STRAIT AT VALLEJO, CALIFORNIA.

Navy Department,
*Washington, August 5, 1903.*

Sir: I have the honor to inclose herewith, for consideration, a copy of a letter,[a] dated the 1st instant, of the Chief of the Bureau of Yards and Docks, relative to the proposed improvement of navigation in Mare Island Strait in front of the naval property at that place, for which Congress authorized an expenditure of $65,000 in the naval appropriation act approved March 3, 1903.

In view of the statements of the Chief of the Bureau of Yards and Docks, the Department concurs in his recommendation that permission be granted by the War Department to change the pierhead line upon the easterly side of Mare Island Strait, as indicated by the chief of bureau and shown on the accompanying blueprint[a] plan.

Very respectfully,

Chas. H. Darling,
*Acting Secretary.*

The Secretary of War.

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[a] Not printed.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 10, 1903.*

Respectfully referred to Col. D. P. Heap, Corps of Engineers, for consideration and report by the Board of Engineers on Harbor Lines for San Francisco Harbor and adjacent waters.

To be returned.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Third indorsement.]

U. S. ENGINEER OFFICE, PACIFIC DIVISION,
*San Francisco, Cal., October 14, 1903.*

Respectfully returned to the Chief of Engineers, War Department, Washington, D. C., with report of the Board accompanying.

D. P. HEAP,
*Colonel, Corps of Engineers,*
*Senior Member*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 30, 1903.*

Respectfully returned to the Secretary of War.

In the within communication the Acting Secretary of the Navy requests a modification of the existing pierhead line on the easterly side of Mare Island Strait at Vallejo, Cal. In a separate communication[a] request was also made for a modification of the present bulkhead line at the same locality.

The matter has been under investigation by the Board of Engineers on Harbor Lines for San Francisco Harbor and adjacent waters, by which a public hearing was held, and attention is respectfully invited to the Board's report of October 14, 1903, herewith. The Board recommends for adoption pierhead and bulkhead lines as shown on the accompanying tracing[a] and described in a separate paper.

Concurring in the views of the Board I recommend that the modified lines selected be approved by the Secretary of War, and that the Secretary indicate his approval on the tracing and description, both of which have been prepared for his signature.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

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[a] Not printed.

## REPORT OF SAN FRANCISCO HARBOR LINE BOARD.

UNITED STATES ENGINEER OFFICE, PACIFIC DIVISION,
*San Francisco, Cal., October 14, 1903.*

GENERAL: The San Francisco Harbor Line Board has had under consideration, and now has the honor to submit, its report on the application of Navy Department to change the bulkhead and pierhead lines on the easterly side of Mare Island Strait, which matter was referred to the Board by second indorsement, dated August 10, 1903.

On receipt of the application, a copy of the inclosed circular[a] was sent to the following parties:

Board of Trade, Vallejo, Cal.,
Vallejo Land and Improvement Company,
R. I. R. Aden, Vallejo, Cal.,
S. W. Wilson, Vallejo, Cal.,
John Brownlie, Vallejo, Cal.,
Gladding, McBean & Co., San Francisco, Cal.,
Southern Pacific Company, San Francisco, Cal.,

and a letter[a], copy inclosed, was sent to Capt. B. H. McCalla, commandant, Mare Island Navy-Yard, informing him of the date of hearing.

A public hearing was held in the office of its senior member on August 28, 1903.

Mr. H. H. Rousseau, civil engineer, U. S. Navy, representing the commandant of the Mare Island navy-yard; Mr. J. H. Wallace, representing the Southern Pacific Company, and Mr. P. McG. McBean, representing Gladding, McBean & Co., were present.

The day prior to the meeting a telegram [a] was received from the Chief of Engineers, United States Army, copy inclosed, which authorized the Board to consider a modification of the bulkhead, as well as of the pierhead lines.

No protests were received, but Mr. McBean submitted a letter,[a] copy inclosed, stating the conditions under which Gladding, McBean & Co. would grant to the United States Government authority to construct bulkheads, jetties, or other constructions for the improvement of the channel along, or in front of, tide lands owned in whole or in part by them.

A communication,[a] also inclosed, from Mr. H. H. Rousseau, giving the reasons for changing the bulkhead and pierhead lines, was forwarded to the senior member of the Board by the commandant of the Mare Island Navy-Yard.

After a discussion of the matter, the Board decided to visit Vallejo on September 3, 1903, and make a personal inspection of the site.

The inspection was made on that day, and some measurements were made to ascertain whether the present pierheads coincided with the authorized pierhead lines.

The Board again met on the morning of September 30, and, on account of apparent discrepancies of various surveys, it was decided to have the present location of the piers carefully surveyed and plotted.

The survey showed that though the heads of the piers had been altered in shape, and in some instances extended, none of them projected beyond the pierhead line approved by the Secretary of War August 2, 1890.

The Board respectfully recommends the following-described lines be adopted and approved in lieu of those approved by the Secretary of War August 2, 1890, covering the same extent of water front: * * *

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[a] Not printed.

[Description follows in separate paper.]

Respectfully submitted.

D. P. Heap,
*Colonel, Corps of Engineers,*
*President of the Board.*
W. H. Heuer,
*Lieut. Col., Corps of Engineers,*
*Member of the Board.*
Thos. H. Handbury,
*Lieut. Col., Corps of Engineers,*
*Member of the Board.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

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### DESCRIPTION OF HARBOR LINES FOR WATER FRONT OF VALLEJO, CAL., ON MARE ISLAND STRAIT, FROM SAN PEDRO STREET TO SOUTHERLY CORNER OF MILL WHARF, RECOMMENDED BY BOARD OF ENGINEERS ON HARBOR LINES FOR SAN FRANCISCO HARBOR AND ADJACENT WATERS.

#### PIERHEAD LINES.

[All lines are straight lines.]

Commencing at a point on the southerly line of San Pedro street extended westerly 920 feet from the southwest corner of San Pedro and Alviso streets, North Vallejo, Cal.; thence to a point on the southerly line of Ohio street extended westerly 1,180 feet from the southwest corner of Trinity and Ohio streets, Vallejo, Cal.; thence to a point on southerly line of Pennsylvania street extended westerly 375 feet from where the westerly line of Santa Clara street intersects the southerly line of Pennsylvania street; thence to a point on the southerly line of Chestnut street extended westerly 1,613 feet from the southwest corner of Fourth and Chestnut streets, South Vallejo, Cal.; thence to a point which shall be on a line perpendicular to the west line of Fourth street, at a point which shall be 480.6 feet southerly from the intersection of said west line of Fourth street with the north line of Lemon street, and 1,871 feet westerly therefrom; thence to a point which shall be on a line perpendicular to the west line of said Fourth street, at a point which shall be 1,654 feet southerly from aforesaid intersection of said lines of Fourth and Lemon streets, and 2,240 feet westerly therefrom; thence to a point which shall be on a line perpendicular to the west line of said Fourth street to a point which shall be 2,232 feet southerly from aforesaid intersection of said lines of Fourth and Lemon streets, and 2,277 feet westerly therefrom.

#### BULKHEAD LINE.

Commencing at a point on the southerly line of San Pedro street extended westerly 65 feet from the southwest corner of San Pedro and Alviso streets, North Vallejo, Cal.; thence to a point on the southerly line of Maine street 230 feet westerly from the southwest corner of Maine and Santa Clara streets, Vallejo, Cal.; thence westerly to the point of intersection of the southerly line of Main street with the pierhead line above described; thence southerly and easterly along the pierhead line as above described, being coincident therewith, to its southerly end; thence easterly at right angles to the pierhead line to the mean low-water line of the shore.

[First indorsement.]

War Department, *December 2, 1903.*

Approved.

E. Root,
*Secretary of War.*

# APPENDIX U U.

## IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN OREGON, OF COLUMBIA RIVER ABOVE THE MOUTH OF WILLAMETTE RIVER, AND OF SNAKE RIVER, OREGON AND WASHINGTON.

### *REPORT OF MAJ. W. C. LANGFITT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

#### IMPROVEMENTS.

1. Coquille River, Oregon, between Coquille and Myrtle Point.
2. Entrance to Coos Bay and Harbor, Oregon.
3. Harbor at Coos Bay, Oregon (dredging).
4. Coos River, Oregon.
5. Mouth of Siuslaw River, Oregon.
6. Yaquina Bay, Oregon.
7. Tillamook Bay and bar, Oregon.
8. Dredging plant for use at harbor on coast of Oregon below mouth of Columbia River.
9. Upper Columbia and Snake rivers, Oregon and Washington.
10. Columbia River at Three-mile Rapids, Oregon and Washington.
11. Canal at the Cascades, Columbia River, Oregon.
12. Operating and care of canal and locks at the Cascades of the Columbia River, Oregon.
13. Columbia River between Vancouver, Washington, and mouth of Willamette River.

#### EXAMINATIONS AND SURVEYS.

14. Columbia River between Vancouver, Washington, and mouth of Willamette River.
15. Umpqua River, Oregon.
16. Yaquina River, Oregon, from its mouth to Elk City.

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Engineer Office, United States Army,
*Portland, Oreg., July 15, 1904.*

General: I have the honor to transmit herewith annual report * * * for the fiscal year ending June 30, 1904, for works of river and harbor improvement in my temporary charge.

Very respectfully, your obedient servant,

W. C. Langfitt,
*Major, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

### CONTRACTS IN FORCE.

*Formal.*—Name of contractor: John Kiernan, Portland, Oreg.

Date of contract: November 10, 1902.

Character of work: Repairing and extending jetty.

Quantities and prices for materials in place: 6,272 linear feet piles, at 16 cents per linear foot; 59,013 feet B. M. lumber, at $14 per M feet B. M.; 3,107.5 pounds drift bolts, at 10 cents per pound; 225 pounds ship spikes, at 10 cents per pound; 1,450 pounds new railroad spikes, at 8 cents per pound; 125 pairs new fish plates, at $1.10 per pair; 273 pounds new bolts and nuts, at 15 cents per pound; 815.55 cubic yards mattress, at $1.50 per cubic yard; 22,094.68 tons stone, at 85 cents per ton of 2,000 pounds; 15.15 tons old rails, relaid, at $11 per ton of 2,000 pounds; new frogs and switches, at $50 per f. and s. [none].

Approved: November 28, 1902.

Date of beginning: Thirty working days after notification of approval.

Date of expiration: Twelve months from date of notification.

Supplement to above contract, dated December 18,1902, provides that John Kiernan shall secure and transfer to the United States the right of way and all privileges of occupancy of certain land for a term of ten years, and that he shall repair an old wharf and build a single track tramway for an approximate distance of 3,000 feet.

Price for all supplemental work: $1,300.

Supplement, approved: January 8, 1903.

Date of beginning: Upon notification of approval.

Date of expiration: In time to complete formal contract within specified date of expiration.

### COMMERCIAL STATISTICS.

The following commerce was carried by vessels across the bar at the mouth of the river during the calendar year 1903:

| Articles. | Inbound. | Outbound. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Broom handles | .......... | 885 |
| Coal | .......... | 507 |
| Fish | .......... | 290 |
| Lumber | .......... | 38,870 |
| Matchwood | .......... | 2,052 |
| Miscellaneous | 4,850 | 772 |
| Wool and woolen goods | .......... | 23 |
| Total | 4,850 | 43,399 |

Number of passengers arrived by sea, 287; departed by sea, 248.

*List of vessels crossing bar at entrance of Coquille River, Oregon, during year ending December 31, 1903.*

| Name. | Character. | Length. | Breadth. | Depth of hold. | Draft when fully laden. | Net tonnage. | Number of times arrived. | Number of times departed. | Total number of times arrived and departed. |
|---|---|---|---|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | | | | |
| Advance | Sail | 139.8 | 34.4 | 9.4 | 11.5 | 265 | 9 | 8 | 17 |
| Albion | do | 80.5 | 27.0 | 5.0 | 8.0 | 75 | 7 | 7 | 14 |
| Antelope | do | 89.5 | 28.5 | 7.0 | 8.0 | 117 | 2 | 2 | 4 |
| Alta (auxiliary gasoline power). | do | 49.0 | 12.6 | 5.5 | 6.0 | 10 | 1 | 1 | 2 |
| Bella | do | 121.0 | 32.0 | 6.0 | 10.0 | 147 | 1 | | 1 |
| Berwick | do | 82.6 | 27.4 | 7.1 | 9.0 | 95 | 1 | | 1 |
| Bender Brothers | do | 77.5 | 24.8 | 6.8 | 8.0 | 80 | 3 | 3 | 6 |
| Corinthian | do | 81.0 | 25.6 | 6.8 | 9.0 | 89 | 2 | 2 | 4 |
| Coquille | do | 92.9 | 29.5 | 6.4 | 8.5 | 97 | 7 | 7 | 14 |
| Chico | Steam | 146.6 | 28.8 | 18.0 | 12.0 | 396 | 25 | 25 | 50 |
| Gem | Sail | 106.9 | 30.0 | 7.0 | 9.0 | 114 | 3 | 4 | 7 |
| Lizzie Prien | do | 94.8 | 30.6 | 6.4 | 8.0 | 91 | 6 | 5 | 11 |
| Mayflower | do | 80.5 | 26.5 | 6.2 | 8.0 | 86 | 9 | 9 | 18 |
| Mary Etta | do | 71.0 | 23.0 | 6.8 | 9.0 | 61 | 3 | 3 | 6 |
| Ocean Spray | do | 80.0 | 25.5 | 7.0 | 8.0 | 71 | | 1 | 1 |
| Onward | do | 134.1 | 35.4 | 10.0 | 13.0 | 255 | 10 | 10 | 20 |
| Ruby | do | 132.0 | 31.0 | 9.0 | 10.5 | 306 | 7 | 8 | 15 |
| Volant | do | 122.8 | 29.0 | 8.9 | 8.0 | 164 | 1 | 1 | 2 |
| Total | | | | | | | 97 | 96 | 193 |

## U U 2.

## IMPROVEMENT OF ENTRANCE TO COOS BAY AND HARBOR, OREGON.

For information concerning the approved project for the improvement of Coos Bay and Harbor, Oregon, attention is invited to the summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

No active operations were carried on during the fiscal year ending June 30, 1904, except to make repairs to buildings, plant, etc., and in making resurvey of the harbor lines and planting about 30 acres of the lower portion of the north spit with Holland grass roots (*Arundo arenaria*).

The buildings belonging to the work at the north spit, consisting of office, quarters, storehouse, mess house, etc., have never been repaired since they were first erected in 1891. They were therefore in a bad condition, and to have them available for future operations authority was obtained and the necessary repairs made. The plant was also gone over, and such repairs as were necessitated by the long storage were made and some of the equipment was thoroughly overhauled for use in dredging at Pony shoal, under allotment from the emergency act.

The planting of the Holland grass roots was continued during the months of March and April, and an area of about 30 acres was covered with plants taken from the previously planted area.

The resurvey of the harbor line was authorized under date of September 6, 1902, and a careful triangulation of the area covered has been made and checked. The field work was commenced in March and completed in May, and on account of dredging operations under the emergency act the map has not yet been completed. It is expected that all of the data pertaining to the survey will be completed and report made some time in July.

There has been very little change in the condition of the jetty on account of the action of the sea during the winter storms. The enrockment has been beaten down to about high tide for about 48 feet of its outer length, and in several short sections the rock has been beaten down or washed off the crest of the jetty to below low-water depth and to the level of the sands on the north side of the structure. There are no apparent changes in the shore lines about the root of the jetty.

A depth of at least 17 feet on the crest of the bar has been carried throughout the year, and it is thought that there will be no further decrease for some time to come.

There still remains a balance of $50,945.38 from the appropriation of June 13, 1902, and it is proposed to make no further extension of the jetty until further funds are appropriated and the condition of the channel requires the expenditure. The old tramway and tracks are fast going to decay and they will be practically useless for further operations. This will entail an additional expense when work is resumed, and while at present no necessity exists for this resumption, no less than $100,000 should be available should completion of present project be taken up.

The construction of a small survey steamer for use on the coast harbors was authorized, and a contract has been made, under date of June 24, 1904, with the Willamette Iron and Steel Works, of Portland, Oreg., for its construction and equipment, at a cost of $24,490. The expense of building this boat is to be borne in equitable proportion by the different coast works.

The work of resurveying the harbor lines has been in charge of Morton L. Tower, junior engineer.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $56,579.93 |
| Deposited, account proceeds Government property | 263.48 |
| | 56,843.41 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 5,898.03 |
| July 1, 1904, balance unexpended | 50,945.38 |
| July 1, 1904, outstanding liabilities | 337.72 |
| July 1, 1904, balance available | 50,607.66 |
| July 1, 1904, amount covered by uncompleted contracts | 15,000.00 |
| Amount (estimated) required for completion of existing project | 1,741,412.20 |

### APPROPRIATIONS.

| Act of— | |
|---|---|
| March 3, 1879 | $40,000.00 |
| March 3, 1881 | 30,000.00 |
| August 2, 1882 | 30,000.00 |
| July 5, 1884 | 30,000.00 |
| August 5, 1886 | 33,750.00 |
| August 11, 1888 | 50,000.00 |
| September 19, 1890 | 125,000.00 |
| July 13, 1892 | 210,000.00 |
| August 18, 1894 | 95,000.00 |
| June 3, 1896 | 95,000.00 |
| Act of— | |
| March 3, 1899 | $150,000.00 |
| November 10, 1900, refundment of overpayment | .56 |
| Act of June 13, 1902 | 50,000.00 |
| Deposited June 13, 1904, account proceeds Government property | 263.48 |
| Total | 939,014.04 |

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### CONTRACTS IN FORCE.

*Formal.*—Name of contractor: Willamette Iron and Steel Works, Portland, Oreg.
Date of contract: June 24, 1904.
Character of work: Constructing and delivering vessel.
Amount of work: One vessel.
Price: $24,490.
Approval: Notification of approval not yet received.
Dates of beginning and expiration: Vessel to be completed within one hundred and fifty days from date of notification of approval. (In force June 30, 1904.)

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### COMMERCIAL STATISTICS.

The following commerce was carried by vessels across the bar at the entrance to the bay during the calendar year 1903:

| Articles. | Inbound. | Outbound. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Broom handles | | 65 |
| Coal | | 49,906 |
| Chittim bark | | 26 |
| Dairy produce | | 360 |
| Fruit | | 254 |
| Fish | | 856 |
| Laths | | 1,660 |
| Lumber | | 63,924 |
| Live stock | | 39 |
| Machinery | 261 | |
| Miscellaneous | 13,853 | 3,923 |
| Match wood | | 413 |
| Piles | | 80 |
| Vegetables | | 51 |
| Woolen goods | | 7 |
| Total | 14,114 | 121,064 |

Number of passengers arrived by sea, 2,430; departed by sea, 2,578.

*List of vessels crossing the bar at entrance to Coos Bay, Oregon, during the year ending December 31, 1903.*

| Name. | Character. | Length. | Breadth. | Depth of hold. | Draft when fully laden. | Net tonnage. | Number of times arrived. | Number of times departed. | Total number of times arrived and departed. |
|---|---|---|---|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | | | | |
| Abbie | Sail | 98.5 | 29.5 | 8.3 | 10 | 138 | 1 | 1 | 2 |
| Aberdeen | Steam | 169.8 | 34.2 | 11.8 | 13 | 394 | 1 | 1 | 2 |
| Acme | do | 177.5 | 37.0 | 5.2 | 14 | 275 | 4 | 4 | 8 |
| Advent | Sail | 151.5 | 35.0 | 12.6 | 17 | 399 | 4 | 4 | 8 |
| Alliance | Steam | 164.4 | 35.6 | 12.0 | 16 | 431 | 36 | 35 | 71 |
| Alpha | Sail | 144.0 | 35.0 | 9.0 | 11 | 274 | ........ | 1 | 1 |
| Alta | Gasoline | 46.0 | 12.0 | 6.0 | 6 | 10 | 1 | 1 | 2 |
| Annie E. Smale | Sail | 200.0 | 40.6 | 16.4 | 17 | 809 | ........ | 1 | 1 |
| Arcata | Steam | 180.0 | 26.2 | 8.6 | 13 | 415 | 36 | 36 | 72 |
| Bella | Sail | 121.0 | 32.0 | 6.0 | 10 | 147 | 1 | 1 | 2 |
| Chas. E. Falk | do | 142.3 | 34.0 | 9.0 | 10 | 245 | 5 | 6 | 11 |
| Chehalis | do | 177.5 | 40.0 | 14.5 | 17 | 642 | 2 | 2 | 4 |
| Chilkat | Steam | 115.5 | 24.0 | 10.5 | 12 | 98 | 1 | 1 | 2 |
| Copper Queen | Gasoline | 50.0 | 10.4 | 5.5 | 4 | 6 | 5 | 5 | 10 |
| Coquille River | Steam | 146.2 | 34.2 | 12.4 | 10 | 265 | 1 | 1 | 2 |
| Czarina | do | 216.0 | 30.8 | 14.1 | 17 | 793 | 25 | 26 | 51 |
| Defiance | do | 122.0 | 22.2 | 14.2 | 15 | 127 | 1 | 1 | 2 |
| Del Norte | do | 158.0 | 32.2 | 12.5 | 14 | 279 | 1 | 1 | 2 |
| Eliu Thompson | do | 195.1 | 28.0 | 20.6 | 17 | 448 | ........ | 1 | 1 |
| Emma Utter | Sail | 134.7 | 33.1 | 10.1 | 12 | 265 | 4 | 5 | 9 |
| Empire | Steam | 170.1 | 32.7 | 20.1 | 17 | 525 | 18 | 18 | 36 |
| Esther Buhne | Sail | 139.6 | 34.0 | 9.0 | 13 | 245 | 3 | 3 | 6 |
| Fannie Adele | do | 115.0 | 30.8 | 9.5 | 12 | 222 | 2 | 2 | 4 |
| Fannie Dutard | do | 126.5 | 31.0 | 10.8 | 13 | 252 | 2 | 2 | 4 |
| Fulton | Steam | 152.7 | 33.5 | 11.4 | 14 | 265 | 1 | 1 | 2 |
| Glendale | Sail | 142.2 | 34.0 | 9.0 | 10 | 281 | 1 | 1 | 2 |
| Guide | do | 126.0 | 26.7 | 7.4 | 10 | 137 | 2 | 2 | 4 |
| Heather | Steam | 165.0 | 28.5 | 14.9 | 15 | 731 | 1 | 1 | 2 |
| Homer | do | 146.0 | 33.8 | 17.0 | 14 | 331 | 8 | 8 | 16 |
| Hunter | do | 95.0 | 21.7 | 10.4 | 11 | 52 | 23 | 23 | 46 |
| Ivy | Sail | 102.5 | 28.8 | 8.8 | 10 | 135 | 10 | 9 | 19 |
| Jas. A. Garfield | do | 140.0 | 37.5 | 10.2 | 12 | 300 | 2 | 2 | 4 |
| Jessie Minor | do | 129.0 | 32.5 | 9.2 | 11 | 219 | 6 | 6 | 12 |
| Jennie Wand | do | 124.0 | 32.8 | 9.0 | 12 | 168 | 1 | ........ | 1 |
| Joseph Russ | do | 124.0 | 30.0 | 9.6 | 12 | 235 | 2 | 2 | 4 |
| Lillian | Steam | 57.5 | 11.2 | 5.3 | 7 | 17 | 1 | ........ | 1 |
| L. Roscoe | do | 90.0 | 22.0 | 9.6 | 10 | 75 | 7 | 6 | 13 |
| Maggie C. Russ | Sail | 117.0 | 30.0 | 9.0 | 11 | 186 | 1 | 1 | 2 |
| Mandelay | Steam | 142.4 | 33.6 | 12.0 | 12 | 266 | 2 | 2 | 4 |
| Manzanita | do | 152.0 | 11.5 | 11.5 | 12 | 450 | 1 | 1 | 2 |
| Melancthon | Sail | 133.0 | 30.5 | 10.9 | 17 | 288 | 4 | 4 | 8 |
| Nevarro | Steam | 126.0 | 32.0 | 10.0 | 15 | 171 | 5 | 5 | 10 |
| Nellie and Cressy | Gasoline | 33.0 | 11.5 | 6.3 | ........ | 8 | 2 | 2 | 4 |
| North Bend | Sail | 153.5 | 32.8 | 11.2 | 16 | 357 | 4 | 4 | 8 |
| Novelty | do | 168.2 | 39.0 | 13.0 | 16 | 584 | 2 | 2 | 4 |
| Orient | do | 126.6 | 30.0 | 10.9 | 13 | 296 | 3 | 3 | 6 |
| Prentiss | Steam | 144.0 | 34.5 | 11.5 | 14 | 267 | 3 | 3 | 6 |
| Repeat | Sail | 148.9 | 34.4 | 12.0 | 14 | 410 | 5 | 5 | 10 |
| Robarts | Steam | 75.5 | 18.2 | 6.5 | 9 | 24 | 5 | 5 | 10 |
| Ruth | do | 151.0 | 33.5 | 10.7 | 15 | 237 | 4 | 4 | 8 |
| Salvator | Sail | 160.0 | 36.0 | 11.6 | 12 | 385 | 5 | 5 | 10 |
| San Buena Ventura | do | 107.0 | 30.0 | 8.5 | 10 | 171 | 6 | 6 | 12 |
| San Gabriel | Steam | ........ | ........ | ........ | 12 | 250 | 1 | 1 | 2 |
| Sausalito | Sail | 236.0 | 38.0 | 15.0 | ........ | 150 | 1 | 1 | 2 |
| Signal | Steam | 150.0 | 34.4 | 13.8 | 16 | 392 | 14 | 15 | 29 |
| South Coast | do | 131.5 | 32.2 | 10.5 | 15 | 225 | 1 | 1 | 2 |
| South Portland | do | 180.2 | 29.0 | 19.7 | 18 | 579 | 2 | 2 | 4 |
| Volunteer | Sail | 128.9 | 38.9 | 12.0 | 15 | 542 | 1 | 1 | 2 |
| Webfoot | do | 146.5 | 31.6 | 10.8 | 13 | 343 | 2 | 2 | 4 |
| Western Home | do | 96.5 | 29.0 | 7.9 | 10 | 128 | 8 | 8 | 16 |
| Total | ........ | ........ | ........ | ........ | ........ | ........ | 301 | 303 | 604 |

## U U 3.

### IMPROVEMENT OF COOS BAY, OREGON (DREDGING).

The first appropriation for dredging in Coos Bay, in addition to the improvement at the mouth of the river, was made by the act of

August 18, 1894, of $13,000, and a further sum of $14,390 was appropriated by the act of June 3, 1896.

The status of this improvement, with further details, is given in the summary of this report.

## OPERATIONS DURING THE FISCAL YEAR 1904.

As reported in the annual report on improvement of Coos Bay and Harbor, Oregon, for the fiscal year 1903, a shoal had formed at the mouth of Pony Slough in Coos Bay, and vessels drawing 9 feet were obliged to lighter their cargoes over the shoal.

On recommendation, an allotment of $10,000 was made on August 5, 1903, from the emergency act of June 6, 1900, which was expended, and the results accomplished not being sufficient for the needs of navigation, a further allotment of $3,500 was made on May 17, 1904, for continuation of the work of dredging.

At the time of the first allotment (August 5, 1903), there was no available plant for doing the work and it was thought advisable to do it by contract. Proposals were accordingly issued on September 22, 1903, but the locality of the work being isolated from points where dredging plants were available, and the season being such that dredges could not well be towed to Coos Bay, no bids were received for doing the work.

The plant previously used in connection with the improvement at the mouth of the river was overhauled, a new hull built, and some old machinery installed thereon for use in dredging. Two old scows were converted into dump scows and the actual work of dredging commenced on January 25. During the progress of the work continued stormy weather prevailed, which made operations very uncertain and expensive, and the results were not as satisfactory as they would have been under more favorable circumstances.

Operations were suspended on April 3, approximately 6,490 cubic yards of mostly pure ocean sand having been removed, and the depth over the shoal increased from about 9 to 11 feet at mean lower low water over a stretch of channel of about 100 feet.

The resulting depth not being sufficient for the needs of navigation, the dredge was again put into commission immediately on notification that additional funds were available. Dredging was again resumed in the early part of June and at the close of the month 3,720 cubic yards were removed from a stretch of 650 feet in length, making a channel 60 feet wide. A total of 10,210 cubic yards have been removed since commencement of operations in April.

A recent examination of the channel shows that the cut has maintained its depth since beginning work and it is thought that the balance remaining from the allotment of $3,500 will secure sufficient depth temporarly for all needs of navigation. To maintain the required depth of channel from the entrance of this bay to Marshfield, the head of deep-sea navigation, will no doubt require dredging from time to time, necessitating further expenditures. The maintenance of this channel, it is believed, should be made a part of the improvement of Coos Bay and Harbor (general improvement) and no amount is therefore named in the money statement to be appropriated.

This work has been in charge of Mr. Morton L. Tower, junior engineer.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $70.72 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 6, 1900, and June 13, 1902 | 13,500.00 |
| | 13,570.72 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 9,878.07 |
| July 1, 1904, balance unexpended | 3,692.65 |
| July 1, 1904, outstanding liabilities | 1,071.35 |
| July 1, 1904, balance available | 2,621.30 |

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#### APPROPRIATIONS.

| | |
|---|---|
| Act of August 18, 1894 | $13,000.00 |
| Act of June 3, 1896 | 14,390.00 |
| | 27,390.00 |
| February 2, 1900, refundment of overpayment made by voucher No. 37, January, 1899 | 9.75 |
| Act of June 6, 1900 (allotted) | 10,000.00 |
| Act of June 13, 1902 (allotted) | 3,500.00 |
| Total | 40,899.75 |

---

## U U 4.

## IMPROVEMENT OF COOS RIVER, OREGON.

The project for obtaining a channel 50 feet wide, free from obstructing bowlders and snags, from the mouth of the river in Coos Bay to the head of tide on the North and South forks, and the result of operations, are mentioned in the Annual Report of the Chief of Engineers for 1900, pages 644–645 and 4283, 4284.

### OPERATIONS DURING THE FISCAL YEAR 1904.

The operations during the fiscal year have been confined to snagging in accordance with the approved project for expenditure of available funds, the expense of fitting up the plant for use in this work being charged in part to allotment from the emergency act for dredging in Coos Bay.

A new hull was built for a combined snag and dredge scow and immediately upon suspension of operations of dredging in Coos Bay the plant was taken to Coos River and the work of snagging begun. The work was commenced on April 7 on the South Fork and was completed on the 25th, when the plant was taken up the North Fork and the channel cleared of the worst obstructive snags, and operations suspended on the 23d of May. A total of 449 large snags and 463 smaller ones were removed during the time that operations were in progress, leaving both the North and South forks free of the worst obstructive snags and overhanging trees.

To thoroughly snag the river and remove some obstructive bowlders in the channel would require about six months' work with the snagboat and crew, in addition to which there are several shoal places on the lower river which could be improved by dredging and revetment work.

It is estimated that with the present plant available $5,000 could be profitably expended, and this sum is accordingly named in the money statement that should be appropriated should this work be undertaken.

## *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,000.00 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 1,541.25 |
| July 1, 1904, balance unexpended | 458.75 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 5,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

## APPROPRIATIONS.

| | |
|---|---|
| Act of— | |
| June 3, 1896 | $5,000 |
| March 3, 1899 | 3,000 |
| June 13, 1902 | 2,000 |
| Total | 10,000 |

## COMMERCIAL STATISTICS OF COOS RIVER, OREGON.

| Articles. | Up freight. | Down freight. | Article. | Up freight. | Down freight. |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | | *Tons.* | *Tons.* |
| Coal | 465 | | Machinery | 139 | 20 |
| Chittim bark | | 58 | Miscellaneous | 521 | 288 |
| Dairy produce | | 1,396 | Piles | | 778 |
| Eggs | | 31 | Vegetables | | 350 |
| Fruit | | 483 | Wool | | 16 |
| Fish | | 28 | | | |
| Grain | 171 | | Total | 2,120 | 25,989 |
| Hay | 152 | 233 | Up freight | | 2,120 |
| Lumber | 672 | | | | |
| Logs | | 21,895 | Total | | 28,109 |
| Live stock | | 418 | | | |

| | |
|---|---|
| Number of passengers carried up river | 11,560 |
| Number of passengers carried down river | 12,339 |
| Total | 23,899 |

The following are the regular steamers plying Coos River:

| Name. | Character. | Length. | Breadth. | Depth. | Draft loaded. | Net tonnage. |
|---|---|---|---|---|---|---|
| Alert | Stern wheel | 81 | 18 | 4 | 3 | 31 |
| Alma | Screw | 50 | 12 | 3 | 2 | 9 |
| Blanco | do | 61 | 16 | 6 | 5 | 18 |
| Coos River | do | 44 | 12 | 5 | 4 | [illegible] |
| Flyer | do | 63 | 15 | 5 | 6 | 31 |
| Sumner | Gas screw | 30 | | | 3 | 5 |
| Telephone | do | 36 | 8 | 3 | 2 | 7 |

In addition to the above-named there are several gasoline boats and launches in the stream owned and operated by farmers living in the valley. Owing to the formation of the country, transportation other than by water is at present impracticable. The stream is therefore used as a highway for transporting practically all the commerce and passengers of the region.

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## U U 5.

## IMPROVEMENT OF SIUSLAW RIVER, OREGON.

For further details of this work, with status of improvements, see summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

There were no operations during the past fiscal year other than those in connection with the watching and care of the Government plant used in construction of the north jetty in former years.

The last survey of the bar and entrance was made in August and September, 1902, and shows a least depth in the bar channel of 5 feet at mean lower low tide. A report of this survey, under date of February 5, 1903, was referred to the Board of Engineers for Rivers and Harbors for consideration and report as to the advisability of continuing the improvement. This report is printed in the Annual Report of the Chief of Engineers for 1903, pages 2229–2239, and further reference is given in the summary of this report.

The condition of the partially built north jetty remains about as it was at the close of last active operations, in December, 1900. The receiving wharf and jetty tramway used in depositing stone on the north jetty are more or less decayed, and they would practically have to be rebuilt in case operations are resumed on the jetty extension.

Should Congress decide to go on with this work the balance available is too small for economical prosecution, and an additional appropriation in this contingency of at least $70,000 should be made, and this sum is therefore named in the money statement for expenditure to June 30, 1906.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $31,787.90 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 646.00 |
| July 1, 1904, balance unexpended | 31,141.90 |
| July 1, 1904, outstanding liabilities | 50.00 |
| July 1, 1904, balance available | 31,091.90 |
| July 1, 1904, amount covered by uncompleted contracts | 5,000.00 |
| Amount (estimated) required for completion of existing project | 513,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 70,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

### APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| September 19, 1890 | $50,000 | March 3, 1899 | $30,000 |
| July 13, 1892 | 20,000 | June 13, 1902 | 35,000 |
| August 18, 1894 | 25,000 | | |
| June 3, 1896 | 27,000 | Total | 187,000 |

### COMMERCIAL STATISTICS.

The following commerce was carried by vessels across the bar at the mouth of the river during the year ending December 31, 1903:

| Articles. | Inbound. | Outbound. | Articles. | Inbound. | Outbound. |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | | *Tons.* | *Tons.* |
| Chittim bark | | 21 | Machinery | 1,020 | |
| Dairy produce | | 11 | Miscellaneous | 3,143 | |
| Fruit | | 15 | Wool and woolen goods | | 12 |
| Fish | | 515 | | | |
| Laths | | 400 | Total | 4,163 | 21,174 |
| Lumber | | 20,200 | | | |

Number of passengers arrived by sea, 114; departed by sea, 108.

*List of vessels crossing the bar at entrance to Siuslaw River, Oregon, during the year ending December 31, 1903.*

| Name. | Character. | Length. | Breadth. | Depth of hold. | Draft when fully laden. | Net tonnage. | Number of times arrived. | Number of times departed. | Total number of times arrived and departed. |
|---|---|---|---|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | | | | |
| Acme | Steam | 177.5 | 37.0 | 5.2 | 14.6 | 275 | 6 | 6 | 12 |
| Bella | Sail | 121.0 | 32.0 | 6.0 | 11.0 | 147 | 6 | 4 | 10 |
| Bender Brothers | do | 77.5 | 24.8 | 6.8 | 9.0 | 80 | 6 | 6 | 12 |
| C. A. Klose | do | 145.0 | 36.5 | 9.0 | 11.0 | 370 | 3 | 3 | 6 |
| Lillian | Steam | 57.5 | 11.2 | 5.3 | 7.0 | 17 | | 1 | 1 |
| L. Roscoe | do | 90.0 | 22.0 | 9.6 | 10.0 | 75 | 8 | 9 | 17 |
| Mary Etta | Sail | 71.0 | 23.0 | 6.8 | 9.0 | 61 | 6 | 4 | 10 |
| Oakland | do | 148.0 | 36.0 | 9.5 | 14.0 | 383 | 1 | 1 | 2 |
| Ocean Spray | do | 80.0 | 26.5 | 7.0 | 10.0 | 71 | 3 | 3 | 6 |
| Roberts | Steam | 75.5 | 18.2 | 6.5 | 8.6 | 24 | 18 | 19 | 37 |
| Sacramento | Sail | 100.7 | 31.2 | 6.5 | 9.0 | 124 | 7 | 7 | 14 |
| Wing and Wing | do | 104.0 | 30.0 | 8.2 | 11.0 | 134 | 5 | 5 | 10 |
| Total | | | | | | | 69 | 68 | 137 |

## U U 6.

## IMPROVEMENT OF YAQUINA BAY, OREGON.

For information relative to the various projects for the improvement of Yaquina Bay, Oregon, attention is invited to the summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

No operations were carried on during the past fiscal year, other than those in connection with watching and caring for the Government plant used in construction of the jetties in past years. The old rails and cars, and other unserviceable articles of plant, were inspected and condemned on September 15, 1903, and have been sold and removed from the works.

The north and south jetties are fairly well maintained, although somewhat beaten down at their outer ends. The jetty tramways and wharves used in former years are decayed, and the tramway has, to a great extent, been carried away by the sea. A practical rebuilding of all these will be necessary should further improvement be undertaken.

A report of a Board of Engineer officers, convened by Special Orders, No. 20, Headquarters, Corps of Engineers, was made under date of September 26, 1903, further details of which will be found in the summary of this report.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $4,071.98 |
| Deposited account proceeds Government property | 1,334.06 |
| | 5,406.04 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 974.49 |
| July 1, 1904, balance unexpended | 4,431.55 |
| July 1, 1904, outstanding liabilities | 50.00 |
| July 1, 1904, balance available | 4,381.55 |
| July 1, 1904, amount covered by uncompleted contracts | 1,500.00 |

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### APPROPRIATIONS.

| | |
|---|---|
| Act of— | |
| June 14, 1880 | $40,000.00 |
| March 3, 1881 | 10,000.00 |
| August 2, 1882 | 60,000.00 |
| July 5, 1884 | 50,000.00 |
| August 5, 1886 | 75,000.00 |
| August 11, 1888 | 150,000.00 |
| September 19, 1890 | 165,000.00 |
| July 13, 1892 | 85,000.00 |
| August 18, 1894 | 50,000.00 |
| Act of— | |
| June 3, 1896 | $25,000.00 |
| Deposited account sales: | |
| August 17, 1903 | 4.00 |
| December 31, 1903 | 861.93 |
| January 4, 1904 | 204.65 |
| June 23, 1904 | 263.48 |
| Total | 711,334.06 |

### COMMERCIAL STATISTICS.

The following commerce was carried by vessels across the bar at the entrance to the bay during the year ending December 31, 1903:

| Articles. | Inbound. | Outbound. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Coal | 30 | ........ |
| Flour and feed | ........ | 608 |
| Miscellaneous | 81 | 115 |
| Wool and woolen goods | 6 | ........ |
| Total | 117 | 718 |

Number of passengers arrived by sea, 29; departed by sea, 1.

*List of vessels crossing the bar at entrance to Yaquina Bay, Oregon, during the year ending December 31, 1903.*

| Name. | Character. | Length. | Breadth. | Depth of hold. | Draft when fully laden. | Net tonnage. | Number of times arrived. | Number of times departed. | Total number of times arrived and departed. |
|---|---|---|---|---|---|---|---|---|---|
| | | *Feet.* | *Feet* | *Feet.* | *Feet.* | | | | |
| Acme | Steam | 177.5 | 37.0 | 5.2 | 14.0 | 275 | 1 | 1 | 2 |
| Columbine | do | 145.0 | 26.5 | 12.3 | 13.0 | 212 | 1 | 1 | 2 |
| Geo. R. Vosburg | do | 75.5 | 20.0 | 8.7 | 10.0 | 66 | 2 | 2 | 4 |
| Gerald C | Gasoline | 60.0 | 18.0 | 5.0 | 6.0 | 24 | 3 | 3 | 6 |
| Heather | Steam | 165.0 | 28.5 | 14.9 | 14.0 | 731 | 2 | 2 | 4 |
| Hunter | do | 95.0 | 21.7 | 10.4 | 11.0 | 52 | 4 | 3 | 7 |
| L. Roscoe | do | 90.0 | 22.0 | 9.6 | 10.0 | 75 | 2 | 2 | 4 |
| Manzanita | do | 152.0 | 26.0 | 11.5 | 13.0 | 450 | 2 | 0 | 2 |
| Robarts | do | 75.5 | 18.2 | 6.5 | 8.6 | 24 | 16 | 16 | 32 |
| W. H. Harrison | do | 92.0 | 20.1 | 6.8 | 8.0 | 52 | 2 | 2 | 4 |
| Total | | | | | | | 35 | 32 | 67 |

## REPORT OF BOARD OF ENGINEERS RELATIVE TO THE DESIRABILITY OF CONTINUING OR MODIFYING THE EXISTING PROJECT FOR THE IMPROVEMENT OF YAQUINA BAY, OREGON.

[Printed in House Doc. No. 158, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 2, 1903.*

Sir: I have the honor to submit herewith a report, dated September 26, 1903, with map, by a special Board of Engineers on the project for improvement of Yaquina Bay, Oregon, with a view to making recommendations upon the desirability of continuing the same or any modification thereof.

This report is made in pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, transmitted to this office by Hon. T. E. Burton, with letter of April 25, 1903, the same being quoted in the accompanying report.

This locality has been improved by the General Government under a project designed to obtain a depth of 17 feet at high water by the construction of two converging jetties at the entrance, the sum of $710,000 having been appropriated for the work; and the depth in 1902, at mean high water, being 18 and 19 feet, the average range of tides being 5.9 feet.

For reasons set forth in its report the Board concludes that existing conditions do not warrant continuing the improvement at the present time with a view to securing increased depths at the harbor entrance, but it believes that the existing works should be maintained in such state of efficiency as to maintain present favorable conditions until such time as it may be conclusively shown that further improvement is demanded and warranted or that the work should be abandoned altogether, and recommends that a general fund be provided from which necessary allotments could be made for emergency work. This report has been duly considered by the Board of Engineers for Rivers and Harbors, referred to in the resolution, which agrees with the special Board in its conclusions.

I concur in these views and in the recommendation of the Board of Engineers for Rivers and Harbors, in its report of October 30, 1903, that there be appropriated the sum of $25,000 to provide for maintenance of the existing work for several years, including the repair of damages occasioned by storms.

I recommend that this letter and papers be transmitted to the Speaker of the House of Representatives, for the information of Congress, as requested in the above-mentioned resolution.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., September 26, 1903.*

GENERAL: The Board convened by Special Orders, No. 20, Headquarters, Corps of Engineers, July 10, 1903, has the honor to submit the following report on Yaquina Bay, Oregon. The order referred to is as follows:

SPECIAL ORDERS, No. 20.

HEADQUARTERS, CORPS OF ENGINEERS,
UNITED STATES ARMY,
*Washington, July 10, 1903.*

By authority of the Secretary of War, a Board of officers of the Corps of Engineers, to consist of Lieut. Col. William H. Heuer, Maj. John Millis, Maj. William C. Langfitt, will assemble at Portland, Oreg., upon the call of the senior member, to consider and report upon the subject of the improvement of Grays Harbor, Washington, and of Yaquina Bay, Oregon.

The Board is authorized to visit such points as it deems necessary for the proper performance of its duties.

* * * * * * *

By command of Brig. Gen. Gillespie:

FREDERIC V. ABBOT,
*Major, Corps of Engineers.*

In addition to this order, the following instructions were received by the Board:

COMMITTEE ON RIVERS AND HARBORS,
HOUSE OF REPRESENTATIVES UNITED STATES,
*Washington, D. C., April 25, 1903.*

MY DEAR SIR: I inclose a copy of a resolution adopted by the Committee on Rivers and Harbors during the last week of the present session of Congress. It is not in due form, as it is not certified by the clerk. He is now at Cleveland. In a few days I will have him send a formal copy.

I have some question whether this report should not come from you rather than from the Board. This is, however, a matter of form rather than of substance.

Very respectfully, yours,

T. E. BURTON.

Gen. G. L. GILLESPIE,
*Chief of Engineers.*

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*July 13, 1903.*

Respectfully referred to Lieut. Col. W. H. Heuer, Corps of Engineers, senior member of the Board constituted by Special Orders, No. 20, Headquarters, Corps of Engineers, current series.

The nature of the report contemplated by the said order is set forth in paragraph 1 of the accompanying copy of resolution of the Committee on Rivers and Harbors of the House of Representatives.

It has been found impracticable for the Board on Rivers and Harbors, constituted in accordance with section 3 of the act of June 13, 1902, to make the desired report on Grays Harbor and Yaquina Bay.

To be returned.

A. MACKENZIE,
*Acting Chief of Engineers.*

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EXTRACT FROM RESOLUTION OF THE HOUSE COMMITTEE ON RIVERS AND HARBORS.

*Resolved by the Committee on Rivers and Harbors,* That the Board of five engineer officers, established by section 3 of the river and harbor act of June 13, 1902, be requested to make reports to Congress not later than the first Monday in December, 1903, upon the following projects, with a view to making recommendations upon the desirability of continuing the same, or any modification thereof, or to report, as specifically stated, with the designation of the respective projects:

* * * * * * *

Grays Harbor, Oreg. [Wash.], jetty.
Yaquina Bay, Oreg.

* * * * * * *

The Board met at Portland, Oreg., September 11, 1903, at 11 a. m., and on September 15, at 11 a. m., a public meeting was held in the town hall of Newport, Oreg., on Yaquina Bay, due notice of this meeting having been previously given in newspapers, by circular letters, and otherwise. All papers submitted at the public meeting or received by mail are hereto attached as Appendices "A" to "H."

The first appropriation for this work was made in 1880, and up to and including the act of August 18, 1894, $685,000 were made available. Two converging jetties were built of rubblestone, the north being 2,800 feet long and the south 3,748 feet long. The outer ends were kept at a distance apart of 1,000 feet. The project contemplated a resulting depth of 17 feet at high water, a gain of 7 feet over previous existing depths. This increase was obtained in 1892, and has since been practically maintained. At times this depth is, for very short periods, decreased a foot or two through severe storm action, afterwards to be again recovered. At the time of the visit of the Board the least depth on the bar was somewhat over 17 feet at mean high water. The crest of this bar is found about 2,500 feet beyond the end of the jetties. About 2,000 feet inside the line joining these ends is found an inner bar with about 16 feet depth at mean lower low water, and farther up the bay there are other shoals separating areas of deeper water. In other words, should much increase in depth of water be obtained on the outer bar improvement of these inner bars or shoals would also be necessary, adding a very considerable item of expense.

The total area of harbor room over 18 feet in depth is only about one-third of a square mile, and much of this area is too narrow for anchorage room. Since the last work of jetty extension in 1894–95 there has been but little money available for maintenance, and such work was really not considered necessary. As a result, trestle, approaches, wharves, etc., through natural causes of decay, are now practically worthless for any future operations. The plant, being largely wornout at cessation of operations, is nearly worthless and of antiquated patterns. The rubble mounds forming the jetties have maintained themselves in efficient condition, though the outer ends for some distance have been beaten down by the sea. This is, of course, unavoidable and to be expected.

Between the ends of the jetties and the crest of the bar and extending directly across the channel is found bed rock, the depth to which at mean lower low water is but 18 to 19 feet. To get a channel entrance of greater depth than this would require the removal of a very large area of this rock at a correspondingly great cost. Practically, then, the presence of this rock limits the amount of improvement obtainable. The sundry civil act approved March 2, 1895, contained the following item:

> That the President of the United States is hereby authorized to appoint a board, to consist of three officers of the Engineer Corps, who shall make an examination of the bar of Yaquina Bay, in Oregon, with a view to a project for deeper water, and shall report the result of such investigation, with estimate of cost, to the next regular session of Congress: *Provided*, That the cost of said investigation, and also surveys and expenses of said board, shall be defrayed from the balance of money available of the appropriation made for improving the harbor at Yaquina Bay, in Oregon, by Act of Congress of August seventh [eighteenth], eighteen hundred and ninety-four.

In compliance with the above provision a Board, consisting of Lieut. Col. Amos Stickney, Maj. James C. Post, and Maj. Clinton B. Sears, Corps of Engineers, U. S. Army, was convened and made its report under date of October 11, 1895, which report is printed as House

Document No. 68, Fifty-fourth Congress, first session (Annual Report, Chief of Engineers, 1896, pp. 3285–3287).

The Board appointed pursuant to these provisions evidently only contemplated obtaining, if possible, this limited increase, for it is stated in their report: "The Board is of the opinion that if any further permanent deepening of this bar can be made it will be only by prolonging the present jetties." A project was formulated for the extension of the north jetty 2,100 feet and of the south jetty 2,000 feet, and for the removal of detached rocks in the entrance. The estimated cost of this project was $1,025,800, of which $25,000 were for removal of these detached rocks. The Board also was not called upon to express an opinion as to the desirability of further work.

The river and harbor act of June 3, 1896, provided as follows:

> "Improving Yaquina Bay, Oregon: Continuing improvement, twenty-five thousand dollars: *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the project as recommended by the Board of Officers of the Engineer Corps October eleventh, eighteen hundred and ninety-five, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one million dollars, exclusive of amount herein and heretofore appropriated."

Before the money thus provided was spent or pledged, the river and harbor act of March 3, 1899, provided as follows:

> Yaquina Bay, Oregon: The Secretary of War is hereby authorized to appoint a board of three engineers who shall make examination thereof, with a view to ascertaining the desirability of prosecuting the work authorized by the river and harbor Act of eighteen hundred and ninety-six, for such modification thereof as, in the judgment of said board may be desirable for the commerce of said bay, together with an estimate of the cost of such work, and until such report shall have been made and acted upon by Congress, no further action shall be taken by the Secrelary of War in pursuance of existing law, and five thousand dollars, or so much thereof as may be necessary, is hereby appropriated to pay the expenses of such examination.

Pursuant to this provision, a Board of officers consisting of Col. S. M. Mansfield, Capt. Harry Taylor, and Capt. Wm. W. Harts, Corps of Engineers, U. S. Army, was appointed, and after full consideration of the subject reported their conclusion as follows:

> *Conclusion.*—It is the opinion of the Board that the commerce of Yaquina Bay does not render it advisable to prosecute the work as authorized by the river and harbor act of 1896, except as it refers to the removal of these detached rocks, and that this harbor is unworthy of further improvement at the present time, with the exception of the removal of the said cluster of rocks for which the following estimate of cost is submitted:

| | |
|---|---|
| Removing 1,200 cubic yards submerged rock, at $15 per cubic yard | $18,000 |
| Superintendent contingencies | 2,000 |
| Total | 20,000 |

> If the funds now on hand are available for this work, it is thought that no further appropriation by Congress will be necessary for this work.

The $25,000 appropriated by the river and harbor act of 1896 being available, together with unexpended balances, the detached rocks were removed to a least depth of 12 feet at mean lower low water. The total appropriation for this harbor, therefore, amounts to $710,000.

In the following table are given the statistics of commerce over Yaquina bar, depth at mean high water, and, for comparison, similar data of three other Oregon coast harbors, viz, Siuslaw, Umpqua, and Tillamook.

| Year. | Yaquina bar. | | Umpqua bar. | | Siuslaw bar. | | Tillamook bar. | |
|---|---|---|---|---|---|---|---|---|
| | Commerce. | Depth, mean high water. | Commerce. | Depth, mean high water. | Commerce. | Depth, mean high water. | Commerce. | Depth, mean high water. |
| | *Tons.* | *Feet.* | *Tons.* | *Feet.* | *Tons.* | *Feet.* | *Tons.* | *Feet.* |
| 1881 | ........ | ........ | 15,233 | (a) | ........ | 9 to 10 | ........ | (c) |
| 1882 | 1,830 | 14 to 17 | ........ | (a) | ........ | (b) | ........ | (c) |
| 1883 | 1,359 | 17 | ........ | (a) | ........ | (b) | ........ | (c) |
| 1884 | 4,995 | 19 | ........ | (a) | ........ | (b) | ........ | (c) |
| 1885 | 9,951 | 18 | ........ | (a) | ........ | (b) | ........ | (c) |
| 1886 | 6,219 | 20 | ........ | (a) | ........ | (b) | ........ | 16 to 18 |
| 1887 | 24,694 | 18 | ........ | (a) | ........ | (b) | ........ | (c) |
| 1888 | 23,431 | 21 | 21,839 | (a) | ........ | (b) | ........ | (c) |
| 1889 | 32,921 | 18 to 19 | ........ | (a) | ........ | (b) | 3,571 | (c) |
| 1890 | 40,074 | 18 to 19 | 30,427 | (a) | ........ | (b) | 27,427 | (c) |
| 1891 | 27,540 | 18 | 34,072 | (a) | ........ | 13 | 28,292 | 18 |
| 1892 | 27,111 | 17 to 22 | 27,165 | (a) | 2,381 | 12 | 33,220 | (c) |
| 1893 | 24,767 | 21 | 22,936 | (a) | 7,000 | ........ | 18,316 | (c) |
| 1894 | 23,345 | 19 to 21 | 22,660 | (a) | 8,050 | ........ | ........ | (c) |
| 1895 | 24,589 | 19 to 22 | 24,891 | (a) | 15,296 | 12 | 29,712 | (c) |
| 1896 | 17,883 | 22 | 17,953 | (a) | 7,184 | 11 to 14 | 25,977 | (c) |
| 1897 | 15,364 | ........ | 22,420 | 19 | 2,239 | 12 to 14 | 29,405 | 21 to 22 |
| 1898 | 10,380 | 22 | ........ | (a) | 4,350 | 14 | 35,885 | (c) |
| 1899 | 5,990 | 19 | ........ | (a) | 4,907 | 13 | 36,835 | (c) |
| 1900 | 691 | 18 | ........ | (a) | 18,675 | 11 to 14 | 17,640 | (c) |
| 1901 | 576 | 17 to 19 | ........ | (a) | 22,351 | 11 to 14 | 21,147 | (c) |
| 1902 | 1,152 | 18 to 19 | ........ | (a) | 25,213 | 13 | 24,883 | 21 |

[a] No data available, but mean high-water depths, as given by tug masters, varied from 17 to 20 feet.

[b] No data available, but from best information obtainable mean high-water depths varied from 9 to 15 feet.

[c] No data available, but mean high-water depths, as given by tug masters, varied from 15 to 22 feet.

Statistics for Yaquina bar prior to 1895; for Umpqua bar, Siuslaw bar, and Tillamook bar, prior to 1896, are for fiscal years ending June 30. For the years following the statistics are for calendar years. Statistics for years not named are not available.

From the above table it is seen that while the depths on Yaquina bar compare favorably with those of the other harbors mentioned, the commerce over it does not; that is, the facilities for commerce now offered at Yaquina Bay are not utilized, in spite of the general prosperity of the last few years and the great development in all lines of transportation and commerce. This may be, and no doubt is, due in part, however, to unfavorable local conditions making the development of lumber and other industries more costly, thus requiring greater inducements in way of cheap rates of transportation to enable these industries to compete with those of more favored localities. This, it is contended by local interests, requires that the larger vessels capable of entering foreign trade (as opposed to small coastwise craft) shall be able to frequent the harbor. Attention is invited to the papers submitted and attached hereto for details and interesting information regarding the scope of country and resources more or less naturally tributary to this harbor. It should be remarked that lumber forms by far the largest item of the resources.

The large increase in activity in oriental commerce, generally speaking, and especially in lumber, on this coast, since the report of the Mansfield Board, may continue and require that the lumber tributary to this entrance be given an outlet here by which foreign commerce in this article can be carried on. In the opinion of the Board, however, this time has not arrived.

In conclusion, the Board finds that since the date of the report of the Mansfield Board the work has suffered some deterioration from the action of the sea in carrying away pile and trestle work and in displacing rock and reducing the effective height of the jetties and groins. Construction plant and buildings have also deteriorated by decay and the action of the elements, as is usual in case of unused property of this kind. While there are favorable indications of future developments in the commerce that would be benefited by increased depth at the harbor entrance, it is not found that any material improvement in the commercial conditions as they existed at the time of the report of the Mansfield Board have as yet actually taken place, or that the existing depth or the available harbor facilities are now being utilized to their full extent, or even to the extent that they formerly were, though the commercial statistics show some improvement in the last year or two. Further, the Board does not find that the conditions warrant continuing the improvement at present with a view to securing increased depth at the harbor entrance. The Board believes, however, that existing works should be maintained in such state of efficiency as to maintain existing favorable results until such time as it may be conclusively shown that further improvement is demanded and warranted, or that the work should be abandoned altogether. In view of the fact that present depths have been practically maintained for the past ten years, and taking into account the present condition of the jetties, the Board is of the opinion that, notwithstanding the fact that some deterioration may be expected, these jetties will maintain these depths for some years to come, perhaps until the general policy as just indicated is settled. As by far the larger part of the cost of restoring and maintaining the jetties at their heights and lengths will be in renewing plant, trestle, approaches, and auxiliary works, and as this portion will not cost appreciably more a few years hence than now the Board does not recommend an appropriation for this purpose at the present time. It does recommend that a careful watch be maintained, and should there be shown positive indications that marked deterioration is occurring necessary action should be taken. To provide for such emergencies a general fund should be provided, from which the necessary allotments could be made.

Accompanying this report is map reduced from latest survey (1899) of this entrance. A new survey was not considered necessary by the Board.

Respectfully submitted.

W. H. HEUER,
*Lieut. Col., Corps of Engineers.*
JOHN MILLIS,
*Major, Corps of Engineers.*
W. C. LANGFITT,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

[First indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, October 6, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders No. 24, Headquarters Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie.

H. F. HODGES,
*Major, Corps of Engineers.*

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 30, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has reviewed the within report on Yaquina Bay, and concurs in the opinions and recommendations set forth therein.

Briefly stated, it is the opinion of the Board that it is not desirable for the United States at present to continue the improvement of Yaquina Bay, with a view to securing increased depth at the harbor entrance, but that it is desirable that existing works should be kept in such state of efficiency as will maintain existing favorable conditions until such time as it may be shown that further improvement is warranted, or that the work should be abandoned altogether.

To provide for maintenance of the existing works for several years, including the repair of damages occasioned by storms, it is recommended that there be appropriated the sum of $25,000.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## APPENDIX A.

### LETTER OF HON. BINGER HERMANN.

ROSEBURG, OREG., *September 9, 1903.*

MY DEAR SIR: I have your kind favor of the 4th instant in which you invite me to submit any communication in relation to the improvement of the Yaquina Bay entrance, in view of the meeting of the Board of Engineers at Newport, Oreg., on September 15, 1903, pursuant to authority of the War Department, to consider that improvement.

I have recently visited the jetty at the Yaquina Bay entrance and made careful inquiry into the growth and development of the country tributary to the bay, and to the necessity for further improvement at the entrance with a view of securing deeper water upon the bar.

The resources of the country contiguous to the Yaquina Bay are varied and immense.

The forests of merchantable timber which can have access to this entrance rank among the leading products. A short line of railway, not exceeding 7 miles, will penetrate that vast body of timber upon the Siletz River, which is conceded to be a first-class quality, and this railway will deliver the manufactured product or the log to deeper water at the end of 7 miles of land carriage. Should deeper water be obtained on the bar, large-draft ships could enter the bay and carry the lumber product to the outside markets, and this would at once invite the development of the timber resources so close to the bay and which now command a high price in the Portland and San Francisco markets. Small-draft vessels can not compete with ships of larger capacity, as the difference in freight carriage prohibits the exportation. To the output near the waters of the bay should be added that far greater timber reserve on the western slope of the Cascade Mountains along the line of the Corvallis and Eastern Oregon Railway, which has its western terminal on deep water on Yaquina Bay. This timber is upon an area greater than that of the State of Connecticut. In quality it is a superior fir and white-pine species, and is found in apparently inexhaustible quantity. It is all within reach of the railway to Yaquina Bay, and will most profitably find its outlet to the world's markets over the Yaquina Bay bar. At present there is no lumber traffic over this railway to the bay, although trains run daily from the Cascade Mountain timber belt to the bay. This great resource of the State of Oregon must remain less profitably developed simply because ships of deep draft can not enter the Yaquina Bay. Four feet more of water on the bar would enable ships of sufficient draft to cross the bar and reach the railway tracks, there to receive the great shipments by railway which would at once come from the interior of Oregon for transshipment by the ocean carriers. The present draft vessels do not invite this traffic, and therefore a seeming justification is afforded the Department for saying that "the present commerce does not justify the further improvement."

If this be the test we may as well abandon all hope for that commerce which will at once come if the entrance shall be improved.

The test should not be, "Does the present commerce justify further improvement?" but rather, "Will the further commerce, based on the present abundant resources tributary to the improved navigation, justify the improvement?" If this latter test be accepted by the Department and the Board of Engineers an extensive and valuable commerce will immediately follow the improvement, and it will increase in extent and value in proportion as the bar deepens. A glance at the map of Oregon will suffice to show the area of territory tributary to Yaquina Bay. The railway now connecting the bay with interior Oregon has already reached a point on the summit of the Cascade range of mountains. An extension of a short distance farther eastward will place the eastern Oregon country in direct communication by rail with Yaquina Bay, and this will add to the commerce the production of a region as great in area as the States of Massachusetts and New Hampshire combined. At present wool and live stock are the leading products. With railroad extension grain and lumber will form the greatest exports. So far, none of the products of this country find outlet to western Oregon except by the long, circuitous, and expensive wagon communication to the Columbia River and thence east or west by river or by rail. A further addition to the commerce of Yaquina Bay in the event of improvement will be the grain and fruit and miscellaneous productions of the central Willamette Valley, one of the oldest settled and largest cultivated portions of Oregon and which is at present in direct communication by rail with the Yaquina Bay.

The great necessity is deeper-draft vessels. We can not have them unless we shall first have further improvement of the entrance to the Yaquina Bay. With them there will be a commerce, and without them shipments over that bar can not compete with the commerce of other more favored shipping points where freight rates on larger cargoes are not prohibitive. Give Yaquina Bay a safe and deep entrance and the commerce to follow immediately will justify the improvement. It will do more than this; it will induce the extension of the present railway to a point where it will connect with eastern roads, thus making Yaquina Bay a western terminal for a transcontinental railway.

I have the honor to be, respectfully, yours,

BINGER HERMANN.

Maj. W. C. LANGFITT,
*Corps of Engineers, U. S. Army.*

## APPENDIX B.

### STATEMENT OF MR. J. K. WEATHERFORD.

GENTLEMEN: As a citizen and taxpayer of the State of Oregon, and indirectly interested in the improvement of the harbors and bays of the State, as well as the general improvement of the State of Oregon, I take pleasure in presenting to your honorable Board such reasons as have suggested themselves to my mind why the Government should renew and continue to a successful completion the improvements at the entrance of Yaquina Bay Harbor.

I am free to confess that I do not feel able or in any way desirous of advising you gentlemen as to the manner of the improvement, or the methods to be employed, or as to whether or not further improvements can be made at this place. You who have given years of study to such questions, and who, by merit, have reached exalted stations in your profession and have achieved merited renown, need no suggestions in that direction. However, it is possible I may have a more intimate knowledge of the demands of commerce and the growing needs of our people situated in the immediate vicinity of and tributary to this harbor than you gentlemen possess. I therefore desire to call your attention to the extent of country tributary to this point, and which would be directly benefited by the improvement if it should be continued until vessels of deep draft could enter the harbor. That portion of Oregon directly interested in and to be benefited primarily by such improvement consists of Lincoln, Benton, Linn, Marion, Lane, and Crook counties. These several counties have an area of 18,000 square miles, and now contain a population of over 100,000 people, and are rapidly increasing—a territory larger than Maryland, New Jersey, Connecticut, and Rhode Island, and as rich and fertile as was the famed valley of the Nile in the palmy days of the Pharaohs—a land truly flowing with milk and honey, a land that will give happy homes for a million people and better support them than it does the few that now occupy it, a territory that is practically undeveloped and scarcely touched by the hand of man.

That portion of this territory situated in the Willamette Valley is fully 75 miles in length and 75 miles wide, being the counties referred to. Within this territory is situated nearly all of the population mentioned. Not one-half of this territory is under cultivation, and that which is under the plow is not made to yield as it should or as it would if the population was greater. Yet, from these counties, annually, go to the markets of the world products as follows, as shown by the address of the Albany Commerce Committee, presented at a meeting of the Board of Engineers of the United States at a public meeting held in Newport on the 22d day of April, 1899:

| | Amount. | Value. |
|---|---|---|
| Wheat........bushels.. | 7,253,820 | $4,849,694 |
| Oats........do.... | 4,400,329 | 1,275,150 |
| Barley and rye........do.... | 311,985 | 124,000 |
| Hay........tons.. | 43,500 | 2,918,500 |
| Hops........pounds.. | 18,172,000 | 2,271,500 |
| Cattle........head.. | 216,682 | 4,332,560 |
| Hogs........do.... | 637,793 | 639,100 |
| Sheep........do.... | 501,857 | 1,253,632 |
| Wool........pounds.. | 5,128,800 | 641,000 |
| Potatoes........bushels.. | 2,788,600 | 732,800 |
| Dried fruit........pounds.. | 24,808,000 | 868,250 |
| Green fruit........do.... | 82,824,000 | 648,840 |
| Poultry........dozen.. | 192,000 | 391,000 |
| Eggs........do.... | 15,750,000 | 1,730,000 |
| Butter and cheese........pounds.. | 4,332,955 | 841,138 |
| Lumber........feet.. | 157,910,000 | 1,421,190 |
| Total........ | ........ | 24,938,474 |

There has been a 25 per cent increase since that date in the productions of the territory, however; the figures above include Clackamas, Yamhill, and Douglas counties in addition to those referred to by me.

The total amount of imports into Linn County, annually, will reach $2,000,000; into Marion, $2,500,000; into Polk County, $1,000,000; Benton County, $1,000,000; into Lincoln County, $250,000; Lane County, $2,000,000. To bring the amount of imports used annually into Linn County it would require 5,000 carloads. To carry out the produce shipped to the markets will require 10,000 cars annually. The same of Marion and Lane counties, and one-half that number each for Polk and Benton. This is based upon the products of the farm, the field, and the factory, without reference to the vast amount of merchantable timber situated in the Coast and Cascade range of mountains tributary to Yaquina Bay. There is fully 1½ million acres of timber land. These lands, at a conservative estimate, will produce 75,000,000,000 feet of lumber, which, for the want of reasonable freight rates and shipping facilities, can not be utilized profitably at the present time. In Lincoln, Benton, Marion, Linn, Lane and Crook counties over one-half of the territory of each county consists of forests of Douglas or noble fir, cedar, spruce, Oregon pine, oak, ash, and maple—the finest timber found anywhere in the United States, and of immense value, and which will give employment for many thousand men for years and years to come, to manufacture it into lumber, carry to the lines of railroad, rivers, and other shipping points, and thousands and thousands of cars and vessels of all kinds and character to carry to market.

It may be suggested that this material can find easy and rapid transportation by lines already established or the Columbia River. At the present time Portland is the headquarters for the lumber business in Oregon, yet from the Isthmus of Panama or Nicaragua it is more than 250 miles farther than it is from Yaquina Harbor. The timber in the counties mentioned is tributary to the Corvallis and Eastern Railroad in part, and necessarily tributary to Yaquina. Should it be shipped to Portland, a distance of 125 to 150 miles, and then 220 to 225 miles back before it reaches a point opposite Yaquina, it would be an added expense of money, time, and labor so much so as to prevent the immediate opening up and developing of this vast section of timber land. At the present time, stumpage tributary to the Columbia River is worth $1.50 to $2 per thousand, while stumpage in the country tributary to Yaquina Bay is not worth to exceed 50 cents per thousand, and no ready sale for it at that. If the harbor of Yaquina should be opened and vessels carrying 1,200 tons and upward could with safety enter the harbor, the stumpage would be worth from $1.50 to $2 per thousand.

It may be suggested that only a portion of this timber would find its way to the market through Yaquina Harbor, which we readily admit; yet the mere fact of its being opened and vessels bidding for freight would have a salutary influence upon the whole of the shipping of the State of Oregon.

It was suggested by the Board of Engineers that met here four years ago that there was nothing tributary to the harbor to justify the improvement. I beg to challenge the correctness of that suggestion and to call the attention of this honorable Board to one fact, which is not referred to, so far as I have been able to discover, in the arguments of any gentleman before the Board at that time. That in Lincoln County alone there is in the neighborhood of 250,000 acres of timber land, as shown by a letter from the honorable surveyor-general of Oregon, to which I have permission to refer, in which he states that at a conservative estimate there are 30,000 feet to the acre, which gives 7,500,000,000 feet board measure. This timber extends from the ocean to the summit of the coast range of mountains. If it becomes necessary to market this timber by way of Portland, the freight from Yaquina to Portland would be probably $3.50 per thousand feet, and from there to the markets it would necessarily have to be carried back past the entrance to this harbor, at an additional cost of probably 50 cents per thousand, making $4 per thousand for freights alone to put it aboard a vessel and transport it as far south as Yaquina; 7,500,000,000 feet of lumber, at $4 per thousand, extra freight paid for it, would give us the sum of $30,000,000. If a saving of this amount can be made to the small county of Lincoln on the timber alone, where the forests as yet have not been touched by the ax of commerce, nor a tree fallen for the markets, should it not be done?

This timber can not be carried to the market at present prices or at the present time unless it can find its way through this harbor. To carry it East of necessity requires carrying it over a range of mountains, heavy grades, and a long haul; but if this harbor could be improved so that vessels could moor at the mill and the lumber pass from the saw into the hold of the ship it would readily be sought after and manufactured.

The county of Lincoln in which the harbor of Yaquina is situated has an area of probably 2,500 square miles, and is capable of supporting a rural population of as many thousand. The land is fertile and rolling, and anything that is planted can be grown successfully, and as fast as the timber is taken from the soil the country will be converted into farms and pastures and towns and cities will grow up where now is a wilderness of forests.

The loss of shipping at this point is accounted for by the fact that vessels carrying over 400 or 500 tons can not, with safety, cross the bar, while vessels carrying 2,000 tons and upward are the class usually employed in visiting the other ports on the coast. A vessel carrying 400 tons can not compete with one carrying 2,000 tons, for the reason that their fixed charges are substantially the same. At one time a large amount of produce was shipped to San Francisco by the Yaquina and from there transported to the foreign markets. It is not done now, for the reason that the foreign charters at the present time can be had almost as cheap at Portland as at San Francisco. The local freight to Portland is less than it could possibly be from the Willamette Valley by Yaquina to San Francisco and there be unloaded and again reloaded upon a foreign-bound ship. This probably is the main reason why the local freight is not shipped through this harbor.

We can only expect the products of the farm, the field, and the forests can be carried to the markets of the world in vessels of large tonnage, and unless the bar can be made safe and convenient for vessels carrying at least 1,200 tons and upward, our efforts would be in vain. But if it can be, and the Government, in its justice, should conclude to open up this port, and to make it what it was contemplated in the inception of the work done, it certainly would be a wonderful boon to all of the State of Oregon and add immensely to the productiveness of wealth and employment of labor and thereby be of great value to the Government.

The commencement of work on the Panama or Nicaragua canal by the Government would be the signal for an immense advance in all industrial lines on the Pacific coast, but especially in the forests. The completion would bring us in close touch with the commercial centers of the world, and Oregon, that has moved slowly but firmly, would throw off its inertia and leap forward with the powers of a giant, and the rapid development of her vast and varied resources would astonish even the most sanguine. Open this harbor and give to the people living tributary to it an opportunity to develop of its unbounded resources so as to be ready to take advantage of and assist in the industrial enterprises which must surely follow. Then the Corvallis and Eastern Railroad, centering at this bay, with renewed vigor would build through eastern Oregon and open up a territory comprising one-half of the State now used for grazing purposes only, yet rich in mineral, in timber, and agricultural possibilities. There towns and cities would spring into existence as if by magic. There would indeed be a revolution greater than any witnessed for generations.

I believe I echo the sentiments of one-half of the people of the State of Oregon when I in all seriousness ask you to give us a favorable report, and use your good offices in this, to us, most important matter. Do not say there is no commerce; do not say it is not worthy. We have shown that the timber of Lincoln County alone will justify all the expenditure the Government has made or will be called upon to make and that it is a mere bagatelle of the greater interests of the remainder of the State.

We can not remain stationary; we must either advance or recede. As citizens of the greatest nation on the face of the globe we will not recede, but will meet all obstacles and overcome them. The people here represented to-day are either pioneers or their descendants, who helped to make this State and preserve it to the Union, and they ask that their services may be remunerated by developing the shipping ports so that the returns for their labor may be enhanced and their patriotism rewarded.

We make no demands, but as citizens anxious for the prosperity of our country come before you, a jury of our peers, selected to pass upon this most important matter, and ask you to grant our request, if in justice, equity, and good conscience you can do so. It will be a saving to the Government because it will be a saving to the people, because it will make homes for the homeless, because it will give employment, and because it will open another transcontinental line of railroad, and because it will make our people more prosperous, contented, and happy.

I thank you for your attention and kind consideration of our requests.

J. K. WEATHERFORD.

The honorable the BOARD OF ENGINEERS,
(Having charge the contemplated improvement of the Yaquina Harbor.)

## APPENDIX C.

### LETTER OF MR. C. B. MONTAGUE.

LEBANON, LINN COUNTY, OREG.,
*September 14, 1903.*

SIR: I have the honor to acknowledge receipt of your letter of 4th instant, requesting a presentation in writing to the Board of Engineers, U. S. Army, which meets at Newport, Oreg., on September 15, 1903, giving reasons why the improvements at the entrance to Yaquina Bay Harbor should be renewed and continued, and beg to submit the following for the consideration of the Board:

The administration, in explanation of its sudden expansion and its foreign policy, assures us that we may expect an immediate and continuing increase in our foreign trade with the Orient, and that the Pacific coast is destined to get a large part of this trade. This is doubtless true, and we may confidently hope that the promises of the Administration will materialize. This trade can be carried on only by the aid of ships, which can not load or discharge cargo without the protection of a safe harbor, easy of access from the ocean. Under present conditions the Columbia River affords the only safe entrance for vessels bringing cargoes into Oregon. Exports from Oregon have now to be carried from the extreme south end of the State and across the State to reach the mouth of the Columbia River, necessarily a long haul and a very heavy tax on the producer or shipper. This fact alone shows that the State of Oregon needs a seaport nearer to its center that would afford an easy, safe, and economical outlet to the best markets for the sale of our immense surplus products, and this, in my judgment, is ample reason why the improvements at the entrance to Yaquina Bay Harbor should be renewed and continued. Let the Government make Yaquina a safe harbor, easy of access from the ocean, and shipping will come to carry away our immense surplus of cereals, hay, hops, potatoes, dairy products, and, greater than all and overshadowing all our industries, our magnificent lumber; our horses, our cattle, our dairy products. The natural resources of Oregon are immense; given easy access to our water transportation, our condition would be ideal; as a lumber-producing State, it is attracting the attention of the entire world. Near the Pacific coast the forests of Oregon will yield 50,000 to 100,000 feet per acre. One acre of such timber land will yield more tonnage than one acre of wheat land in tonnage for a period of one hundred years. The Cascade and Coast mountains are the chief lumber supply. A belt 20 miles wide on the Cascade extending through the State, is densely timbered. A careful canvass of the timber resources of the State, according to a recent special report on the timber industry of the United States, shows a total stand of about 225,000,000,000 feet—an amount so great as to be incomprehensible to the common run of men. The lumber and logging business in the State is moving with much vim. Large sums of money are being invested in timber land; sawmills, with capacities of 50,000 to 250,000 feet per day, are multiplying in Linn, Lane, and Marion counties. These counties are in the center of the great timber belt of the Cascades, and are within 60 to 80 miles of Yaquina Bay entrance. Lincoln, Benton, Polk, Yamhill, and Tillamook counties have the magnificent timber belt of the western slope of the Coast Range within their borders, every foot of which is easily accessible to the harbor of Yaquina, 10 to 70 miles distant. The immense capital invested in timber lands and the lumber industry in those counties adjacent to Yaquina Harbor is anothor good reason why the improvements at the entrance to Yaquina Bay Harbor should be renewed and continued.

A close approximate estimate of the products of the farm in Linn, Lane, Benton, Polk, and Marion counties, of which Yaquina Bay is the rational outlet to the ocean, gives us for the year 1903:

5,000,000 bushels of wheat.[a]
5,000,000 bushels of oats.[a]
850,000 bushels of potatoes.
1,000,000 pounds of butter and cheese.
5,000,000 pounds of hops.
80,000,000 feet of lumber.
4,000,000 pounds of dried fruit.

While these estimates are approximate, yet there is no doubt they will be found near enough correct to base a pretty accurate estimate of the amount of tonnage that, with proper facilities of water transportation by the shortest route, would be sought by the producers of the counties named at the harbor of Yaquina. While many additional facts might be added favoring this much-needed improvement, it is sincerely hoped that sufficient has been cited to show to the Board of Engineers that there are several very good reasons why the improvements at the entrance to Yaquina Bay harbor should be renewed and continued.

Most respectfully submitted,

C. B. MONTAGUE.

Maj. W. C. LANGFITT,
*Corps of Engineers, U. S. Army.*

## APPENDIX D.

### STATEMENT OF MR. B. F. JONES.

(Polk County has same amount as Lincoln County.)

There are 200,000 acres of timber lands in Lincoln County that expert timber cruisers have estimated will average 35,000 feet per acre, aggregating the enormous amount of 7 billion feet of merchantable saw timber. Allowing that this timber at the present time is only worth the sum of 25 cents per thousand feet as it now stands in the tree, the present value of this timber would be $1,750,000.

Manufacture it into lumber, and at the present price of $15 per thousand all around it would be worth the sum of $105,000,000. To move this timber when manufactured into lumber it would take a vessel with a carrying capacity of 1 million feet, if she made one trip out of this harbor every day, nineteen years to move this lumber; and it would require 10 sawmills of a daily capacity of 100,000 feet nineteen years to manufacture this timber into lumber; and it would require the labor of 1,000 men every day in the year for nineteen years to operate the mills while they were manufacturing this lumber.

At the present prices paid for labor, the pay roll of these men would amount to $75,000 per month.

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[a] One-fourth of this estimate required for home consumption.

It is less than twenty years since, in the States of Michigan, Wisconsin, and Minnesota, that timber standing in the tree was worth only 25 cents per thousand. The present value of timber in these States is from $10 to $15 per thousand standing in the tree, or, as commonly termed, stumpage.

Timber experts estimate that, at the present rate of consumption for lumber, all the timber in the United States will be practically exhausted in twenty-five years. Therefore, judging the future by the past, it will scarcely be a dozen years before timber in Oregon will be worth $10 and $15 per thousand as it stands waving and green as nature has left it.

B. F. Jones, *Toledo, Oreg.*

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## APPENDIX E.

### STATEMENT OF THE MAYOR OF CORVALLIS, OREG.

Gentlemen: Because it is the usual rule for the Government to take into consideration present commerce, claims we make for further appropriations for improvement of Yaquina Harbor are placed at an undue disadvantage. The harbor, its importance, its present influence on traffic rates, and its real function as a harbor, if weighed by the fact of what commerce it now has, is wholly misunderstood and in so much prevented from receiving what is its just consideration. It is a fact that the very presence of the harbor as it now stands, an incompleted work, a harbor with but part of the depth of water that is believed to be possible to its entrance, is a restraining influence for preventing a system of freight rates that would be far above what they now are.

Before the entrance to Yaquina Harbor was improved the freight rate on wheat by Willamette River and ocean to San Francisco was $7 and $8 per ton. The figures are capable of confirmation from records of the steamboat company at Corvallis. The very day that the line via Yaquina Bay to San Francisco was opened the rate dropped to $3.50 per ton. The rate, either by rail or by Willamette River and the Pacific Ocean to San Francisco from Corvallis, is now $4.50 per ton. What made this reduction from the old figures of $7 and $8 to $4.50 per ton? There were more steamer lines on the Pacific between Portland and San Francisco and more steamboats on the Willamette than now, and there were then as many railroad lines overland to San Francisco as now; there was as much wheat produced in the Willamette Valley then as now; there was not even then the organization among transportation lines to keep up freight rates that there is now, yet our farmers pay but $4.50 per ton when they formerly paid $7 and $8 per ton.

The question then becomes, Is it not the Yaquina Harbor that compels these lower rates? That harbor, even in its present form, presents to the transportation lines a certainty that if freight rates are made exorbitant, steamers will be put in connection with the railroad at Yaquina, and a competing line at once go into operation, forcing even a lower freight rate on wheat, flour, and other products than those now existing. Thus measured, while incompleted, Yaquina Bay does not present a formidable array of shipping and a vast ebb and flow of commerce; its readiness at all times to become the route and means for a competitive service is an influence, and the only influence, that deters transportation companies from exacting rates much higher than those now in vogue. On account of this peculiar condition, a condition that arises out of the geographical location of the harbor, of the fact that a railroad connects it with the very center of the State, the only railroad of the kind in all Oregon south of the State's northernmost line—all this places Yaquina Bay in a category of its own, wherein the present commerce of the harbor in no sense measures or determines the harbor's usefulness or importance.

The truth is that if the railroad to Yaquina Bay should be destroyed, and the Government works at the entrance of the harbor be removed, reducing the entrance to its original condition, there is not a doubt that freight rates on all products would return to the former and higher level, or at least to figures much above the present tariffs. In western Oregon alone, all of which the Yaquina route is by reason of river and rail connections with the Yaquina railroad able to serve completely, the annual export of products is about $30,000,000. Taking wheat as a basis, because in the case of wheat the freight advance would probably be the least, an advance of $1 a ton would make a difference to the grower of 3 cents per bushel, which at present prices would be 4 per cent. The increase would cost the people of the 13 counties on their exports $1,200,000 per year, and on their $18,000,000 of imports $720,000 per year, making a difference of nearly two millions in round numbers. Thus, without a ship to sail in over its entrance, the very existence of the railroad link that connects

Yaquina with the heart of western Oregon, wherein reside two-thirds of the whole population of the State, saves millions to the people annually and places Yaquina in a situation not to be measured in importance by the extent of its commerce. The amounts that the Government has at various times appropriated have been returned to the people in reduced freight rates an hundredfold since the work began. If an incompleted harbor presents these considerations, of what inestimable value would be the effect of 3, 4, or 6 feet more of water on the entrance, admitting ships of heavier burden sailing to foreign ports.

Bids for the completed project at Yaquina were once submitted in response to the request of Government engineers, and the total proposed cost is understood to have been but about 25 per cent of the annual estimated saving the harbor makes for the people of western Oregon in a single year. Accordingly, in all good faith it would seem that it might be claimed for Yaquina that whether or not the project should be completed resolves itself into the technical question of whether or not a greater depth of water is possible, a matter to be determined solely by engineering skill.

B. F. Irvine,
*Mayor of Corvallis.*

## Appendix F.

### LETTER OF MR. J. J. WHITNEY.

*Albany, Oreg., September 15, 1903.*

Gentlemen: The question of the advisability of an appropriation for the improvement of the entrance to Yaquina Bay rests, to my mind, upon the question of whether or not the entrance to said bay can be so improved as to make it safe for seagoing vessels of ordinary tonnage to pass in and out of said harbor. Looking back to the time when a line of steamers from this port assisted in carrying the various products of the Willamette Valley and the territory adjacent thereto to San Francisco and to the other markets of the world, it will clearly appear that the matter of so improving said harbor as to accommodate seagoing crafts of ordinary tonnage becomes a matter of vital importance to the people of western Oregon, in view of the fact that at the time when said vessels were engaged in said carrying trade the farmers of the Willamette Valley realized from 5 to 7 cents more per bushel for wheat than they could have realized by shipping on any other line or way of transportation. Take the wheat product alone of that portion of western Oregon that lies adjacent to this port, to wit, Benton, Linn, Lane, Marion, Polk, Yamhill, and Washington counties, and it will be found to be an annual yield of about 3 millions of bushels. Not less than 2 millions of bushels of this annual crop is exported to Liverpool. The saving to the farmers who live in the counties above named on wheat alone will amount to $100,000 annually if they are enabled to ship their wheat through this port. Similar savings would be realized on all other products. From this it will be seen that the improvement of this harbor is a matter of vital importance to the people of western Oregon. It is easy to see that in a few years the products of western Oregon will be quadrupled by force of its increasing population, if this port should be opened to the commerce of the world, by reason of the stimulus thus given to all kinds of agricultural and manufacturing industries. The people of western Oregon stand very much in need of this shorter and less expensive outlet to the markets of the world, and the opening of this port would secure to them a competing railroad and waterway to the commerce of the world.

I know of no new or undeveloped harbors anywhere in our young and growing Commonwealth where an appropriation by the Government would benefit so many people as an appropriation sufficient to open this harbor to the commerce of the outside world. This improvement would add untold millions of wealth to the industrial and business classes of this State consequent upon the great increase of population which would, without question, follow the opening of this port. It would also stimulate a large trade now sleeping in the undeveloped resources of this State, and profitable industries now unthought of would spring up throughout the territory heretofore mentioned. I am impressed with the fact that the decision of the question whether the proposed appropriation shall be made rests largely with you, gentlemen. I have not forgotten the past, when this State was represented in part in the halls of Congress by the Hon. John H. Mitchell in the Senate and the Hon. Binger Hermann in the lower House, that appropriations were cheerfully made to improve this harbor, which resulted in placing a line of small steamers on the route from Newport to San Francisco, bringing prosperity at once to the people of western

Oregon, an uplift to all branches of industry and business. The people of Oregon have confidence in the integrity and ability of the honorable gentlemen whom I have heretofore named and who have so ably represented them in the past in securing the much-desired appropriation to improve this harbor. Gentlemen, this matter is now left with you, and we confidently trust that your findings may be such as to call for the improvement herein prayed for.

All of which is most respectfully submitted.

J. J. WHITNEY.

Lieut. Col. HEUER,
Maj. JOHN MILLIS,
Maj. W. C. LANGFITT,
*Board of Engineers.*

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## APPENDIX G.

### STATEMENT OF JUDGE H. M. PALMER.

OFFICE OF H. M. PALMER,
COUNTY JUDGE OF LINN COUNTY, OREG.,
*Albany, Oreg., September, 1903.*

In the matter of Yaquina Bay improvement.

In the creation of this world every feature of it was created for a good purpose, and the Creator thereof pronounced it good, and the water was separated from the land, and the land was designed for the support of mankind and the beasts of the field and wildwood, and the sea is the great highway of all nations where the ships may ride free to every land. And it is so in the creation of these things that there are also many inlets, bays, or natural harbors all along the coast of this great commercial highway. These are also designed for use and to bring good and serve the children of men, and all we are required to do to reap the benefits of those God-given rights is to do the small part of adding a few needed improvements and develop what is designed to be for our good. Without these needed improvements as they have been made in the past our country would still be a wilderness instead of what is now the most prosperous and progressive nation of the earth. And to-day, gentlemen, we are gathered here at Yaquina Bay, on the shores of the Pacific Ocean, to consider this matter of improvement by the General Government, of which you are its representatives. And we see here the ruins of what was once a pretty good harbor, now gone down in rot and decay—a Government work let loose to go back to the old sand bar and blight the hopes of its people. Why is this? If I were asked the question I would simply answer, I don't know. It ain't like Uncle Sam. And there lies adjacent to this bay a country of grand possibilities and unsurpassed in natural resources—an area of country in the State of Oregon equal to the area of five of our eastern States—that is particularly interested in the improvement of this bay, with forests of timber sufficient to run the sawmills for a century, and a farming country, if properly developed, great enough to feed a nation with its surplus products.

So we think it necessary that Yaquina Bay should be improved to encourage development of our farm lands, and the building of mills and factories all over this vast area of country. The United States is covered over with a network of railroads, and the stations are built on an average of 6 miles apart. The railroad company understands it to be money in their pocket to have stopping places close together; it increases the products of the country and makes business for them, while it also serves as a convenience and is profitable to the people, and enhances the value of all property very materially on account of near-by city markets. It also applies in the matter of those little stopping places along our shores, and Yaquina Bay is one of them. Gentlemen, improve Yaquina Bay. We have now one railroad running here, and we are safe in predicting that there would be others very soon leading into every isolated place in this vast area of country contiguous to this place, now so sparsely settled, and be the means of converting the wilds of the forest into a garden spot, built up with happy homes, and the roaring streams into the mill wheel. Transportation must be cheaper than it now is, and this is the way to cheapen it.

The farmer should prosper better than he is now doing in western Oregon. Give him a way to the sea and the great market centers, with the lowest possible freight rate, and he will do the rest. The United States Government does not build these improvements altogether for the money there may be in it for the Government, but for the upbuilding of a grand country and people, that every community may have all the blessings possible that can be accorded to them. I chance to be a county judge in the State of Oregon for Linn County, located in the Willamette Valley. That county is as large as Delaware, larger than Rhode Island, and half as large as New Jersey. We have 20,000 inhabitants only; they have been coming for fifty years. We have room for 80,000 people, and all do equally well as those already here, with such additional advantages as a thickly settled community brings to a country of unlimited natural resources; so let us with one accord say to-day, improve Yaquina Bay. Let the Government say, improve Yaquina Bay, and she will be improved so the ships of the sea can ride in and out with safety. The people of central and southern Oregon with one voice say, improve Yaquina Bay; and the people are not unreasonable.

And in justice to the old pioneers who blazed the way across the continent and unlocked the gate to this glorious country and withstood the hardships of a frontier life, let us press on with the race that is placed before us, and let no part of the work belonging to this generation go by default.

Respectfully submitted.

H. M. PALMER.

The honorable gentlemen the GOVERNMENT ENGINEERS.

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## APPENDIX H.

### LETTER OF MR. G. A. WESTGATE.

ALBANY, OREG., *September 12, 1903.*

DEAR SIR: Following your invitation to be at Newport on the 16th, anent discussion of the betterment of the entrance to Yaquina Harbor, etc., I regret that I can not be a part of the delegation to meet with Captain Langfitt and his associates on that occasion.

But it seems to me that this is a most appropriate time to plan for the resumption of traffic via Yaquina. At present the crops of the Willamette Valley are selling freely, and it is almost impossible to secure cars to move anything in any direction. The operating department of the Southern Pacific Company refuses to furnish cars for California points. I am already weeks behind on car orders for Portland. The grain trade is suffering for this cause. It is impossible to fill orders, and what promised to be a good season has gone into the doubtful class, simply by reason of the inability of the transportation lines to move the products of the country. We ought not to be shut out from any market that calls for our stuff. The present condition is not new. For five years the shippers of the Willamette Valley have suffered for lack of cars. The Harriman people appear to be taking no steps to cope with the situation. One's thought turns to the time when most of the heavy southward commerce of the valley was cared for by steamers sailing from Yaquina and connecting with your rail lines. Much of our products—flour, feed, grain, and often wheat—have their best markets in California. You will remember that for a long time steamers from Yaquina carried a commerce of 100,000 tons and upward per annum. Owing to the condition of the Yaquina bar, etc., disaster after disaster followed the old Oregon Pacific Company until the *Willamette Valley* was the only steamer left on the route. Had the harbor and its entrance received as much Federal attention as less worthy harbors these lost vessels might still be in the active list.

Since the closing of the Yaquina route freight rates south have advanced from 30 to 50 per cent. The point is this: a few feet more of water on Yaquina bar would save these regions $250,000 to $500,000 per year. Our country is developing rapidly. Lumber without count can not be moved for lack of cars. Grain, flour, feed, potatoes, apples, and many other things are kept out of their natural markets for lack of transportation. The world just now is crying for cascara, and victims are plunging into awful desolation for lack of the chittum bark that grows along the Corvallis and Eastern, and which might be forwarded if our harbor were not neglected.

I wish the gentlemen of the Board of Engineers may see the importance in convenience, in present dollars and cents, and in future possibilities of following up these harbor improvements.

Truly, yours,

G. A. WESTGATE.

Mr. EDWIN STONE,
*Manager Corvallis and Eastern Railroad Company, Albany.*

## U U 7.

## IMPROVEMENT OF TILLAMOOK BAY AND BAR, OREGON.

Information concerning the project (now completed) for obtaining a least depth at mean high tide in the channel between Hobsonville, on Tillamook Bay, and Tillamook City, on Hoquarten Slough, as well as the results of operations in former years, is given in the summary of this report.

At the close of the last fiscal year the Government plant was being operated by hired labor, dredging the shoals in Hoquarten Slough, from which about 10,000 cubic yards had been removed by July 1, 1903.

### OPERATIONS DURING THE FISCAL YEAR 1904.

During the fiscal year operations were continued by hired labor and use of the Government plant on the work of maintaining the projected depth in the channel between Hobsonville and Tillamook City by the removal of sand, gravel, and snags from the channel and by strengthening the existing dikes by the addition of rock.

In order to divert more of the flow of Trask River away from Stillwell ditch, and thus lessen the deposit of gravel in Hoquarten Slough, the South Fork of the Trask River was partially cleared of snags and drift, and 7 piles driven across the North Fork just below its junction with the South Fork.

Dredging and snagging operations were carried on until December 23, 1903, when work was suspended.

The dredge used is a Hayward bucket of 1 cubic yard capacity. The material removed from the shoals consisted of gravel and sand mixed with small snags and spruce limbs. In Hoquarten Slough it was deposited directly on the bank, and in the bay was sluiced behind the dikes or to a distance of 150 feet on either side of the cuts by dumping into a trough supported on a scow, into which a stream of water was pumped. In the slough the channel was made nearly the full width between banks, 60 or 70 feet, and across the shoals in the bay 150 feet wide. During the fiscal year, approximately 40,000 cubic yards of gravel, sand, and mud were dredged, and by last December the least depth in the channel between Tillamook and the lower bay was nowhere less than 4 feet at mean low tide. In addition to the dredging, 376 large and 770 small snags were removed from Hoquarten Slough, and placed on the bank and cut up.

Dicks Point, Wilson River, and Long jetties were repaired by depositing on them at weak places 745 tons of rock in the shape of small bowlders, which were picked up along the south shore of the bay by hired labor, at a cost of about 60 cents per ton.

Much rain fell in the months of February and March, 1904, and the swollen rivers tributary to the bay brought down an unusual amount of sand and gravel, which has decreased the depth in the channel near Junction Island and Long jetty and formed a new shoal in Hoquarten Slough just below the mouth of Stillwell ditch. It is proposed to expend the balance of the available funds in redredging these shoals by hired labor, and also in the further removal of obstructions from the South Fork of the Trask River, and the partial closing of Stillwell ditch to check the deposit of gravel carried through it into Hoquarten Slough. It is thought that sufficient funds are on hand to dredge the channel to the projected depth of 9 feet at ordinary high tide.

It is estimated that $10,000 will be needed every two years to maintain the project, and in addition the sum of $6,000 for changes and additions to the plant to render it more efficient.

The sum of $16,000 is therefore the amount named in the money statement for profitable expenditure for maintenance of the work to June 30, 1906.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $18,463.15 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 8,945.04 |
| July 1, 1904, balance unexpended | 9,518.11 |
| July 1, 1904, outstanding liabilities | 940.00 |
| July 1, 1904, balance available | 8,578.11 |
| July 1, 1904, amount covered by uncompleted contracts | 2,800.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 16,000.00 |

APPROPRIATIONS.

| | | | |
|---|---|---|---|
| Act of— | | Refundment of overpayments, November 10, 1900 | $4.68 |
| August 11, 1888 | $5,200.00 | Act of June 13, 1902 | 27,000.00 |
| September 19, 1890 | 500.00 | Total | 105,704.68 |
| July 13, 1892 | 15,000.00 | | |
| August 18, 1894 | 16,000.00 | | |
| June 3, 1896 | 17,000.00 | | |
| March 3, 1899 | 25,000.00 | | |

COMMERCIAL STATISTICS.

The following statistics are for the calendar year 1903:

| Articles. | Inbound. | Outbound. | Articles. | Inbound. | Outbound. |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | | *Tons.* | *Tons.* |
| Coal | 10 | | Laths | | 102 |
| Chittim bark | | 5 | Lumber | | 11,215.5 |
| Dairy produce | | 296 | Machinery | 20 | |
| Eggs | | 1.5 | Miscellaneous | 3,930 | 865.5 |
| Fish | | 238.92 | | | |
| Fruit | 2 | 1 | Total | 4,141 | 12,720.92 |
| Grain, feed and flour | 179 | | | | |

Number of passengers arriving and departing by sea during the year, 1,440.

*List of vessels crossing the bar at entrance to Tillamook Bay, Oregon, during year ending December 31, 1903, which proceeded as far as or departed from Tillamook City, Oreg.*

| Name. | Character. | Length. | Breadth. | Depth of hold. | Draft when fully laden. | Net tonnage. | Number of times arrived. | Number of times departed. | Total number of times arrived and departed. |
|---|---|---|---|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | | | | |
| Antelope | Sail | 89.5 | 28.5 | 7.0 | 10.0 | 117 | | 1 | 1 |
| Gem | do | 106.9 | 30.0 | 7.0 | 10.6 | 114 | 1 | 1 | 2 |
| Geo. R. Vosburg | Steam | 75.5 | 20.0 | 8.7 | 10.0 | 66 | 16 | 17 | 33 |
| Jennie Thelin | Sail | 91.0 | 29.5 | 8.2 | 10.0 | 138 | 1 | 1 | 2 |
| Sue. H. Elmore | Steam | 90.7 | 23.8 | 8.0 | 10.0 | 131 | 39 | 40 | 79 |
| Volant | Sail | 122.8 | 29.0 | 8.9 | 12.0 | 164 | 1 | 1 | 2 |
| W. H. Harrison | Steam | 92.0 | 20.1 | 6.8 | 8.5 | 52 | 3 | 3 | 6 |
| Total | | | | | | | 61 | 64 | 125 |

*List of vessels crossing the bar at entrance to Tillamook Bay, Oregon, during year ending December 31, 1903, which did not go above nor depart from above Hobsonville, Oreg.*

| Name. | Character. | Length. | Breadth. | Depth of hold. | Draft when fully laden. | Net tonnage. | Number of times arrived. | Number of times departed. | Total number of times arrived and departed. |
|---|---|---|---|---|---|---|---|---|---|
| | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | | | | |
| Acme | Steam | 177.5 | 37.0 | 5.2 | 14 | 227 | 2 | 2 | 4 |
| C. A. Klose | Sail | 145.0 | 36.5 | 9.0 | 11 | 370 | 1 | | 1 |
| Chico | Steam | 146.6 | 28.8 | 18.0 | 15 | 396 | 1 | 1 | 2 |
| C. T. Hill | Sail | 93.0 | 30.0 | 7.5 | 9 | 183 | 3 | 3 | 6 |
| Coquille River | Steam | 146.2 | 34.2 | 12.4 | 10 | 265 | 3 | 3 | 6 |
| Guide | Sail | 126.0 | 26.7 | 7.4 | 10 | 137 | 1 | 1 | 2 |
| Geo. R. Vosburg | Steam | 75.5 | 20.0 | 8.7 | 10 | 66 | 3 | 3 | 6 |
| Jennie Thelin | Sail | 91.0 | 29.5 | 8.2 | 10 | 138 | 1 | 1 | 2 |
| Oakland | do | 148.0 | 35.0 | 9.5 | 14 | 383 | 4 | 4 | 8 |
| Redondo | Steam | 188.0 | 38.0 | 11.5 | 15 | 462 | 3 | 3 | 6 |
| Sequoia | do | 151.0 | 33.7 | 12.0 | 16 | 258 | 3 | 1 | 4 |
| Total | | | | | | | 25 | 22 | 47 |

## U U 8.

## IMPROVING THE VARIOUS HARBORS ON THE COAST OF OREGON SOUTH OF THE COLUMBIA RIVER BY THE CONSTRUCTION AND EQUIPMENT OF A DREDGING PLANT FOR USE THEREON.

The existing projects providing for the improvement of the various harbors, with status of improvement, will be found in the summary of the annual report pertaining to each work.

This new project for the construction of a dredging plant for use on these harbors is based on a letter submitted by the district officer under date of June 7, 1904. The recommendation is concurred in by the division engineer and approved by the Chief of Engineers.

The harbors now under improvement by the General Government are Tillamook Bay and bar, Yaquina Bay, Siuslaw River, Coos Bay and harbor (including Coos River), and the Coquille River, Oregon.

It frequently happens that shoals are formed in the navigable channels, thereby greatly delaying the shipping and requiring immediate removal. There are no suitable dredging plants owned by contractors at these harbors and heretofore, owing to the inadequacy of funds for the purchase of suitable appliancies, such work has been done by small bucket dredges operated by hired labor and ill adapted in many cases to the character of the work. It is therefore thought that it would be advantageous to have a small combined dipper and suction dredge which could be taken from harbor to harbor as the necessity for its use might arise and funds be available.

It is estimated that a suitable combination dredge, together with two dump scows for use at the Oregon coast harbors, can be built for about $50,000. The funds for operating this plant would be taken each year from those available for improvement or maintenance of the particular stream upon which used. For the construction of the dredge and scows, however, a special appropriation should be made.

Should funds be made available, it is proposed to construct the dredge under contract.

## U U 9.

### IMPROVEMENT OF UPPER COLUMBIA AND SNAKE RIVERS, OREGON AND WASHINGTON.

The project for the improvement of the upper Columbia and Snake rivers, and the results of operations in former years, are mentioned in the summary of this report.

#### OPERATIONS DURING THE FISCAL YEAR 1904.

Between Riparia and Lewiston, a stretch of 72 miles in length, the obstructions consist mainly of gravel shoals.

In August, during extreme low water, much difficulty was experienced by the boats in navigating over these shoals. The Government having no suitable plant for work on these shoals and relief being urgent in the interest of local commerce, in that the fruit-raising country along this stretch of river is dependent at this season of the year upon the continuous boat service for shipment of fruit, the Oregon Railroad and Navigation Company's steamer *Norma* was leased by the United States at a rental of $80 per day and was in use for thirty-five days deepening the gravel shoals at Goose Island Rapids, Deadman bar, Willow Rapids, Log Cabin Rapids, Ofields bar, Little Pine Tree Rapids, Steptoe Rapids, Dry Gulch Rapids, and Lewiston Rapids, and in making repairs to dam at Log Cabin Rapids.

The only available means of deepening these bars were by stirring up the gravel with a heavy harrow-like rake dragged repeatedly over the shoal, which, with the sluicing of the current, afforded temporary relief and enabled the boats to make regular trips without delay. The deposits on these shoals are made during each freshet season, and sometimes by winter runs of ice, and consist of gravel ranging in sizes from 1 to 8 inches in diameter, so that the governing depth is frequently reduced by a few large gravel lodging directly in the channel. The governing depth over these shoals before raking was about 3½ feet, while after completion of operations with the *Norma* no difficulty was experienced in carrying a draft of 4½ feet.

In repairing the dam at Log Cabin Rapids some 945 tons of rock were used in closing large gaps and bringing the crest of the dam to about the level of extreme low water. The completion of these repairs gave some 6 inches more water on the adjacent shoal.

Navigation on this section of river is at present confined to three steamers of the Oregon Railroad and Navigation Company, two of which make daily trips between Lewiston and Riparia. On the stretch there are some sixteen shoals more or less troublesome during extreme low-water stage for about two months of the year. At other times there are no difficulties and traffic continues uninterrupted throughout the year.

The present project proposes the dredging of these shoals to a 5-foot depth at low water, which, together with some little blasting and maintenance of constructed dams, is the extent to which work is necessary on this stretch under existing conditions.

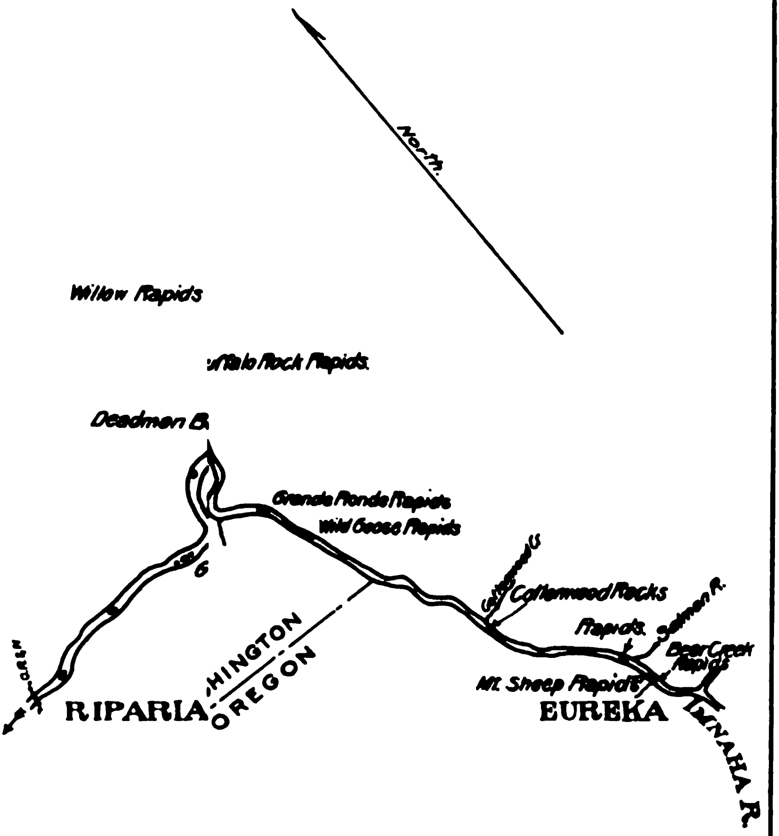
It is expected to carry on the work by operating the dredge now under construction between Riparia and Lewiston for two months or more each low-water season.

The construction of a dredge for the work necessitated additional funds for its operation and an allotment of $5,500 was made on June 21, 1904, from the emergency act of June 13, 1902, for continuation of this work.

The principal obstructions between Lewiston and Pittsburg Landing are ledges of rock and isolated bowlders in and about the swift rapids which at all stages are more or less a menace to navigation.

At the beginning of the low-water season in July a blasting crew in small boats was put at work on the river at Mount Sheep Rapids, Bear Creek Rapids, and above mouth of Salmon River. The work with this crew was continued until the middle of August and the channel widened and deepened and a number of submerged rocks removed at these points. Experience, however, proved it to be impracticable to work safely and effectively from small boats on these rapids, owing to the swiftness of the current, which runs from 10 to 14 miles per hour, and arrangements were therefore made for the leasing of the steamer *Imnaha* at $47.50 per day, without fuel, for use in this work. With the boat it was possible to operate a steam drill on submerged rocks and ledges in mid stream. The boat was put in operation August 15, and worked removing obstructions from low-water channel at Ten-mile Rapids, Buffalo rock, and Grande Ronde Rapids. September 4 the steamer met with a mishap on Wild Goose Rapids, knocking a large hole in her hull, which necessitated discontinuance of work with the steam drill. The boat was taken to Riparia for repairs and the crew was kept at work at Wild Goose Rapids, from small boats, and on high-water obstructions along the bank until September 11, when operations were discontinued for the low-water season. It is impossible to estimate the cubic yards of rock removed from the channel, owing to much of it being blasted in swift water where measurement was impracticable. Some 3,500 pounds of powder were used in these operations.

On October 11, owing to disabling of her machinery when at the head of Mount Sheep Rapids, the steamer *Imnaha* was carried down the rapids and completely wrecked. The mining interests in the vicinity of Eureka have since built another boat with improved machinery



U.S Engineer Office
Portland Or. June 30 1904.

ny Annual Report for Fiscal Year ending June 30 1904.

W C Langfitt
Major. Corps of Engineers U.S.A.

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and it is expected that this boat will begin operations between Lewiston and Eureka in July.

During January a small blasting crew was put at work removing high-water obstructions at Mount Sheep Rapids and Cottonwood Creek. At these two points large rocks, bare at low water, project into the river and at medium and high-water stages cause dangerous currents and eddies and as it is anticipated that the new steamer will navigate to Eureka during these stages the work was deemed advisable.

No work was done above the latter point. The crew was at work three weeks, during which time some 3,000 tons of rock were moved at Mount Sheep Rapids, widening the channel some 30 feet and doing away with over one-half of back eddy, and some 700 tons at Cottonwood Rocks, giving increased width of river at this point. Some 1,000 pounds of powder were used in this work.

An index map of the Snake River, showing the location of the localities under improvement, is herewith.

The river and harbor act of June 13, 1902, provided for the construction of a dredge for use on this improvement. Contracts for a self-propelling steamer dredge, 1 cubic yard dipper capacity, have been let, and at the close of the fiscal year it is under construction. It is expected the dredge will be set up and completed at Riparia and be ready for low-water operations about September 1.

The available balance will be applied to payment for dredge and operating expenses. The additional amount required is for construction of controlling works and maintenance of channel depth by dredging, etc.

It is estimated that to operate the dredge for about four months each year during the low-water season will be sufficient to maintain the channel depths, and for this purpose and the care of plant $15,000 will be required.

### *Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $48,545.42 |
| Deposited account proceeds Government property | | 3.00 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of June 13, 1902 | | 5,500.00 |
| | | 54,048.42 |
| June 30, 1904, amount expended during fiscal year: | | |
| For works of improvement | $5,991.27 | |
| For maintenance of improvement | 4,399.14 | |
| | | 10,390.41 |
| July 1, 1904, balance unexpended | | 43,658.01 |
| July 1, 1904, outstanding liabilities | | 1,545.00 |
| July 1, 1904, balance available | | 42,113.01 |
| July 1, 1904, amount covered by uncompleted contracts | | 31,277.50 |
| Amount (estimated) required for completion of existing project | | Indefinite. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $10,000.00 | |
| For maintenance of improvement | 5,000.00 | |
| | | 15,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

for the improvement of Three Mile Rapids by the removal of submerged rocks and reefs in that vicinity. A contract was accordingly made, under date of April 12, 1904, with the lowest bidder, Mr. Robert Wakefield, of Portland, Oreg., for doing this work. It provides for the removal of approximately 50,000 cubic yards of rock, at $1.50 per cubic yard, and 7,000 cubic yards, at $6.25 per cubic yard. The contract was approved by the Chief of Engineers under date of May 3, 1904, and is to be completed by May 31, 1905. No actual work under this contract has been done owing to high water in the Columbia River.

The sundry civil act of April 28, 1904, made available $100,000 for this work, and a project was submitted under date of June 11, 1904, which included the expenditure of $30,000 available from previous appropriations, and provided for the commencement, under contract, of construction of canal and lock at the upper or Celilo end as soon as the rights of way had been acquired from the State. This project was approved under date of June 29, 1904.

During February and March, five water gauges were reestablished, since which time daily readings of the stage of water have been made and recorded. Two draftsmen have also been engaged in working up details of the gates and masonry construction, and good progress has been made.

The construction of the whole work should be placed under the continuing-contract system, as its early completion is of great importance and will be of vast benefit to the inhabitants of the immense territory drained by the Columbia River. It is considered that this, providing sufficient funds are made available, will result in considerable saving of cost.

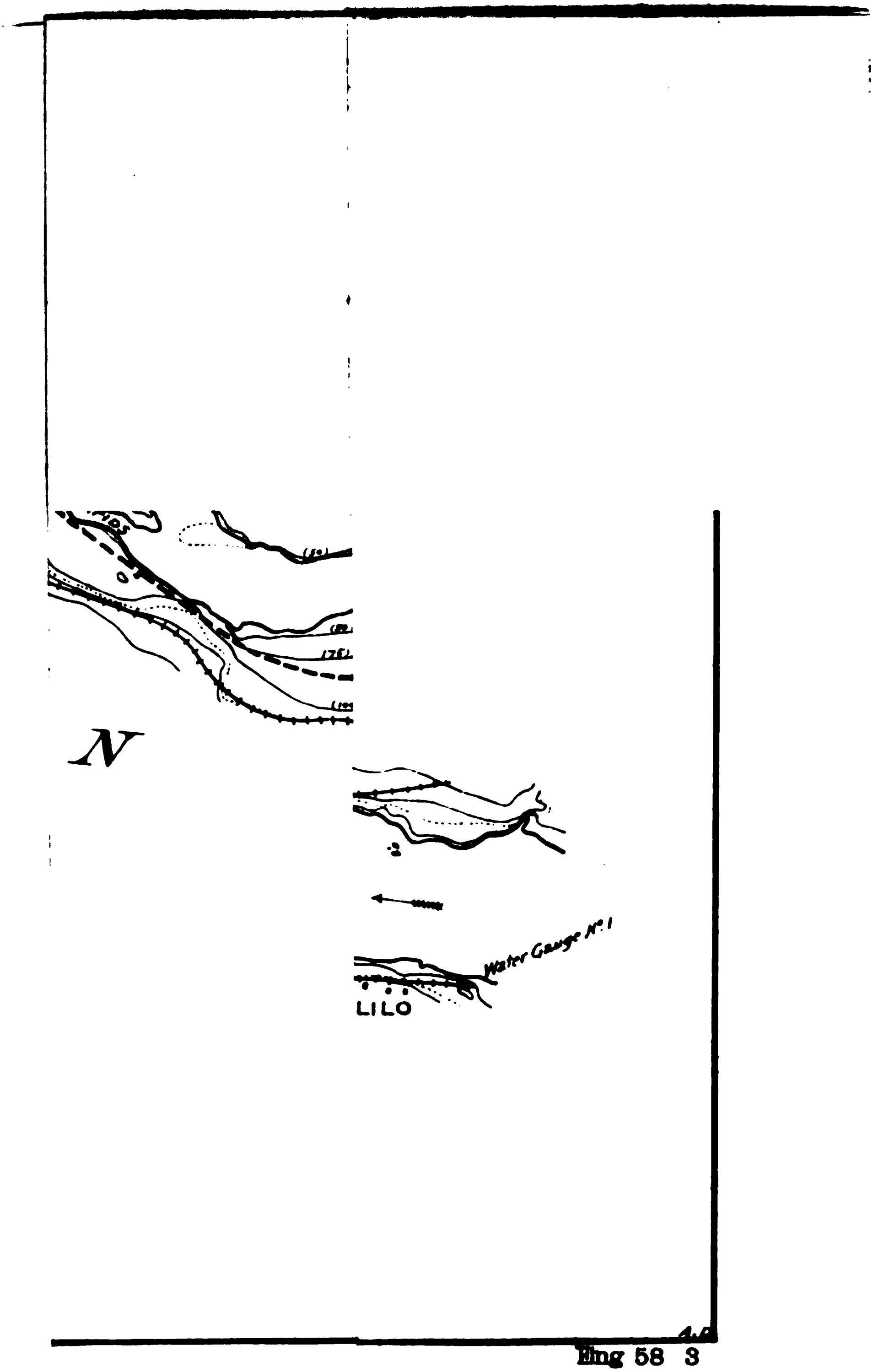
It is estimated that $750,000 can be profitably expended during the fiscal year ending June 30, 1906, and this amount is accordingly named in the money statement.

There is transmitted herewith an index map showing the location of the proposed work and line of canal construction.

Mr. James S. Polhemus, assistant engineer, was in local charge of this work up to October 19, 1903, since which time it has been in charge of First Lieut. Amos A. Fries, Corps of Engineers.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $208,493.02 |
| Amount appropriated by sundry civil act approved April 28, 1904 | 100,000.00 |
| | 308,493.02 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 16,810.66 |
| July 1, 1904, balance unexpended | 291,682.36 |
| July 1, 1904, outstanding liabilities | 75.00 |
| July 1, 1904, balance available | 291,607.36 |
| July 1, 1904, amount covered by uncompleted contracts | 118,750.00 |
| Amount (estimated) required for completion of existing project | 3,829,724.10 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 750,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |



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APPROPRIATIONS.

| Act of— | |
|---|---|
| August 18, 1894 | $100,000 |
| June 3, 1896 | 150,000 |
| April 28, 1904 | 100,000 |
| Total | 350,000 |

CONTRACTS IN FORCE.

**Formal.**—Name of contractor: Robert Wakefield, Portland, Oreg.
Date of contract: April 12, 1904.
Character of work: Excavating and removing rock.
Approximate quantities to be excavated and removed: 50,000 cubic yards rock of Class A (above low water); 7,000 cubic yards rock of Class B (below low water).
Prices: $1.50 per cubic yard for rock of Class A; $6.25 per cubic yard for rock of Class B.
Approved: May 3, 1904.
Date of beginning: Thirty days after date of notification of approval.
Date of expiration: May 31, 1905. (In force June 30, 1904.)

## REPORT OF BOARD OF ENGINEERS ON IMPROVEMENT OF COLUMBIA RIVER BETWEEN THE FOOT OF THE DALLES RAPIDS AND THE HEAD OF CELILO FALLS.

United States Engineer Office,
*New York City, October 23, 1903.*

General: The Board of Engineers constituted by paragraph 6, Special Orders, No. 19, Headquarters, Corps of Engineers, United States Army, Washington, July 5, 1902, to consider and report upon the improvement of the Columbia River, Oregon and Washington, between the foot of The Dalles Rapids and the head of Celilo Falls, has the honor to submit the accompanying report.

Very respectfully, your obedient servant,

W. H. Heuer,
*Lieut. Col., Corps of Engineers,*
*Senior Member.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*

[First indorsement.]

War Department,
Office of the Chief of Engineers,
*Washington, November 4, 1903.*

Respectfully submitted to the Secretary of War.

The river and harbor act approved June 13, 1902, contained an item, quoted at length in the inclosed report, providing in substance for the improvement of the Columbia River in accordance with a plan submitted by Capt. W. W. Harts, Corps of Engineers, when in charge of the work, and providing further that before entering upon the work the plan should be examined by a Board of Engineers, with a view to its modification in such a way as to diminish the cost; and that if it could be so modified, the work should proceed in accordance with the modification; otherwise, in accordance with Captain Harts's plan.

The stretch of the river under consideration is approximately 12 miles long, with a fall of 80 feet at low water. The principal obstructions are Celilo Falls, Ten-mile Rapids, Five-mile Rapids (or The Dalles), and Three-mile Rapids.

Captain Harts's project for overcoming these obstructions is printed in House Document No. 228,[a] Fifty-sixth Congress, second session, herewith. In brief, he proposed to overcome the Celilo Falls by a short lateral canal with two locks on the Washington shore, to provide for open-river navigation from there to Five-mile Rapids by clearing the channel of rocks and opening a relief channel along the line of a secondary high-water channel at Ten-mile Rapids, thus decreasing the slope at that place, and by constructing a submerged dam near the head of Five-mile Rapids, intended to raise the water level 20 feet, thus pooling the water above and in part drowning out the rapids between there and the Celilo Falls Canal; to pass Five-mile Rapids by a lateral canal on the Oregon shore, and to make Three-mile Rapids navigable by removing the obstructions. The cost was estimated in 1900 at $4,000,000, in round numbers.

The Board appointed in accordance with the provisions of the river and harbor act of June 13, 1902, has submitted the accompanying report. It proposes, as a modification of Captain Harts's plan, the construction of a lateral canal on the Oregon shore, from just above Celilo Falls to the Big Eddy just below Five-mile Rapids, this to take the place of the lateral canals at Celilo Falls and Five-mile Rapids, and the submerged dam and other work intended to make the open river navigable between the two. The obstructions at Three-mile Rapids are to be treated as recommended by Captain Harts. The canal proposed by the Board derives its water supply from the river above Celilo Falls, and has four locks, two of which are combined in a tandem lock. The canal trunk is 65 feet wide at the bottom, 8 feet deep, and has "turn outs" or passing points at intervals of about 1 mile. The locks are 250 feet between hollow quoins and 40 feet wide, with a depth of 7 feet over the sills. The total length of the canal is about 8½ miles.

The surveys and estimates for this canal were made by Maj. W. C. Langfitt, Corps of Engineers. He estimates the cost at $4,125,000, which estimate is adopted by the Board. While this sum is in excess of the cost of the project of 1900, as estimated at that time, yet it is less than the execution of that project would now cost, as indicated by the investigations conducted by the Board, which were more exhaustive than those on which the former plan was based. The Board states that the project proposed by it is not only less costly than the project of 1900, but, in the opinion of the Board, is also the least expensive and safest way of satisfactorily improving the Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls by the method contemplated by the act.

The plans herewith were drawn up primarily for purposes of estimate, and the constructing officer should be permitted to make minor changes in details.

The Board's estimate of $4,125,000 is based upon the assumption that sufficient funds will be provided for at the beginning of the work, in order that the economy resulting from the use of an adequate plant may be realized.

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[a] Not reprinted.

While the estimate provides for damages and for the purchase of a right of way, it is the opinion of the Board that no work should be begun until such right of way and release from all damages have been conveyed to the United States free of cost.

The unit prices assumed by the Board are in some cases greater than those which Captain Harts used as a basis for his estimate. Making allowance for these differences, and for a further reduction resulting from the condition that the right of way and release from damages shall be conveyed free of cost, the cost of the modified project is clearly less than that of the former one.

I concur in the views and conclusions of the Board, and recommend that the work proceed under the modified project recommended by the Board, subject to the condition that no work shall be begun until the right of way and release from damages shall have been conveyed to the United States free of cost.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Second Indorsement.]

WAR DEPARTMENT,
*November 6, 1903.*

The project for the improvement of the Columbia River, Oregon and Washington, between the foot of Dalles Rapids and the head of Celilo Falls, as modified by the Board of Engineer officers in their accompanying report, is approved, as recommended by the Chief of Engineers.

This approval is subject to the condition that no work shall be begun until the right of way and release from damages have been conveyed to the United States free of cost.

ROBERT SHAW OLIVER,
*Acting Secretary of War.*

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## REPORT OF BOARD OF ENGINEERS.

This Board was appointed pursuant to the following item of the river and harbor act of June 13, 1902:

> Improving the Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington, by means of canals and the improvement of the channel of the river, in accordance with the report submitted in House Document Numbered Two hundred and twenty-eight, Fifty-sixth Congress, second session: The unexpended balance heretofore appropriated for the purpose of procuring a right of way and commencing the construction of a boat railway at said point is hereby authorized to be used for procuring a right of way and commencing the construction of said canals and commencing the other improvements contemplated as a part of said project: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute said improvement in accordance with the plan approved by the Chief of Engineers, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated, said contract or contracts to be made for such work and materials as will materially forward and advance the completion of said

between Three-mile Rapids and the head of Celilo Falls, and to report what, in their opinion, was the most feasible method of overcoming the obstructions therein, with plans and estimate of cost. The report of the Board is found in Senate Document No. 7, Fifty-third Congress, first session (also in the Annual Report of the Chief of Engineers for 1894, Part 4, p. 2664), Three methods of accomplishing the object sought were discussed. First, a portage railway extending from Celilo to a point below Three-mile Rapids; second, a boat railway; third, a canal. It was reported that a canal could probably be constructed for about $4,000,000. In brief the recommendations of the Board were: First, That a standard gauge portage railway be constructed on the south side of the Columbia River from Celilo to Dalles City, at an estimated cost of $454,390, and second, that when necessity should arise for greater transportation facilities a canal be constructed on the Oregon side. The report concluded with these words:

> The suggestion of a dam at the head of The Dalles to pond the water back to the foot of Celilo Falls has been presented to the Board and has been favorably considered, but the data are not available and can not be obtained at this time to justify this recommendation. The project requires a short canal with locks at Celilo and another from the head of The Dalles Rapids to Big Eddy, and is not free from objection on the score of water rights and fish interests.

One member of the Board dissented from the main conclusion and recommended that a boat railway be built. Another member dissented from the opinion that a high-level canal could probably be built for about $4,000,000, and remarked that the destruction of the salmon fisheries and of the water power above is alone sufficient to eliminate from further consideration a project involving the construction of such a dam.

The act of August 17, 1894, adopted the boat railway project, appropriated $100,000 for beginning its construction, and directed the acquisition without unnecessary delay of the right of way for said boat railway, authorizing the expenditure for this purpose of as much as might be necessary of the $100,000 appropriated.

The act of June 3, 1896, provided $150,000 more for the "construction and equipment of a boat railway from the foot of The Dalles Rapids to the head of Celilo Falls."

The act of June 6, 1900, directed a preliminary examination and survey of the "Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington, with a view to the construction of a canal and locks to overcome the obstructions to navigation." The report contains a project and estimate of cost, and will be found in the Annual Report of the Chief of Engineers for 1901, Part 5, page 3502; also in House Document No. 228, Fifty-sixth Congress, second session. This is the project called herein the "project of 1900," and referred to the present Board for report by the item in the act of June 13, 1902, quoted at the beginning of this report.

With the $100,000 appropriated by the act of August 17, 1894, the line for the boat railway was definitely located, and two small tracts of land were bought and negotiations entered into for purchasing or acquiring by condemnation other lands needed for a right of way.

By June 30, 1898, title had been obtained to the greater part of the land required for right of way and terminal facilities, and the plans for the railway and its appurtenances had been partially prepared.

In the Report of the Chief of Engineers for 1899 it is stated:

> Action looking to the acquisition of land for right of way for this boat railway has been completed, and it only remains now to arrange with the Oregon Railroad and Navigation Company for the exchange of rights of way where the road of that company crosses the line of the proposed boat railway. * * * As this work of removal, with the required grading, etc., will involve an additional expenditure to the United States of some $90,000, and as no appropriation for this boat railway has been made since 1896, the Secretary of War has decided to defer further action in the matter until Congress definitely determines whether or not work of constructing a boat railway shall continue.

In the report of 1900 reference is made to the fact that the steamboat men do not look with favor upon the construction of the proposed boat railway and that "they prefer a portage road or canals and locks."

### THE PROJECT OF 1900.

The report in which the project of 1900 is presented is found in House Document No. 228, Fifty-sixth Congrss, first session (also in the Annual Report of the Chief of Engineers for 1901, pp. 3502 et seq.), and contains a full description of the obstructions found in the stretch of river under consideration. It will not be necessary to repeat here the description of these obstructions. It will suffice to describe the principal elements of the project proposed for overcoming them.

In the language of the report—

> The proposed project for improvement now submitted provides for abandoning the previous boat railway project and for substituting the following: First, a canal about 3,000 feet long, with two lift locks of about 24 feet lift each, extending across the peninsula on the Washington shore in the vicinity of Celilo Falls; second, the removal of the worst obstructing rocks at and below Ten-mile Rapids and the opening of a relief channel along the line of the existing high-water channel on the Washington shore immediately north of and parallel to Ten-mile Rapids; third, the construction of a canal 9,000 feet long around Five-mile Rapids, having two locks (one 33 feet lift and one to be used as a guard lock, for use during high stages), this canal to be along the Oregon shore, its lower end opening immediately below Big Eddy and its upper end to be immediately above the head of Five-mile Rapids, utilizing for this canal, as far as practicable, the more northerly of the two natural high-water canals or channels which now parallel, on the south, the greater portion of Five-mile Rapids; fourth, the construction of a submerged dam or weir immediately below the head of Five-mile Rapids, which will raise the present level of the low-water surface approximately 20 feet, thus drowning out the rapids between this dam and Celilo Falls and reducing the currents in the river between the canal around Five-mile Rapids and that around Celilo Falls, especially at low stages, by increasing the area of the cross section of discharge and diminishing the surface slope; fifth, the removal of the worst obstructing rocks at Three-mile Rapids.

After a careful study of this project the Board has reached the conclusion that it is defective in three particulars:

(*a*) To quote the report—

> The proposed submerged dam immediately below the head of Five-mile Rapids is designed to be made throughout of large blocks of rock or concrete weighing 20 to 30 tons each, deposited at random in a selected narrow part of Five-mile Rapids by means of derricks on either shore. If found necessary, on account of the swift currents, some of the blocks could be anchored to the rocky banks by means of chains. The dam need not necessarily be tight, but should consist of enough blocks to raise the present low-water level 20 feet. Its top would probably need to rise to within a few feet of the present low-water level.

The cost of this dam, as estimated in the project of 1900, is about $105,000, contingencies included.

## CONCLUSION.

A comparison of the advantages and the disadvantages of the various projects considered, and of their cost, led the Board to the conclusion that the least expensive as well as the most secure, feasible, and desirable method of overcoming the obstructions between the foot of Five Mile Rapids and the head of Celilo Falls is a lateral canal on the Oregon side extending from below Big Eddy to the head of the falls, having a higher level at about the elevation of low water at the head of the falls and drawing its water supply from the river at that point.

The accompanying report of Maj. W. C. Langfitt, Corps of Engineers, is a report to the Board on a final location of the canal outlined in the preceding paragraph. The maps and drawings which accompanied that report (except two blueprints) are herewith. Major Langfitt estimates that this canal and all appurtenances can be constructed for about $4,125,000. After a critical examination of the location, the plans, and the estimate, the Board concurs in this opinion.

Referring to the wording of the act, the Board invites attention to the fact that while this sum slightly exceeds the estimated cost of the project of 1900, it is much less than the sum that would be required to execute that project.

The project proposed by the Board is, therefore, not only less costly than the project of 1900, but in the opinion of the Board is also the least expensive and the safest way of satisfactorily improving the Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls by the method contemplated by the act.

Other advantages of the Board's plan are that work can be carried on at all ordinary stages of the river, that probable damage from floods during construction would be a minimum, and that no unusual constructions are involved.

The plans herewith were drawn up primarily for purposes of estimate, and the constructing officer should be permitted to make minor changes in details.

The Board's estimate of $4,125,000 is based upon the assumption that sufficient funds will be provided for at the beginning of the work in order that the economy resulting from the use of an adequate plant may be realized.

While the estimate provides for damages and for the purchase of a right of way, it is the opinion of the Board that no work should be begun until such right of way and release from all damages have been conveyed to the United States free of cost.

*Estimate for continuous canal between Celilo, Oreg., and Big Eddy, Columbia River.*

[Prepared for Board of Engineers, constituted by Special Orders, No. 19, paragraph 6, Headquarters, Corps of Engineers, July 5, 1902. Survey of July to October, 1903.]

| | |
|---|---|
| Dry rock excavation, 1,058,581 cubic yards, at $1 | $1,058,581.00 |
| Subaqueous rock excavation, 900 cubic yards, at $10 | 9,000.00 |
| Subaqueous gravel excavation at Celilo entrance, 9,985 cubic yards, at $1 | 9,985.00 |
| Gravel or sand excavation, 835,986 cubic yards, at 25 cents | 208,996.50 |
| Gravel or sand back fill behind canal walls in sand or gravel, 162,967 cubic yards, at 15 cents | 24,445.05 |

| | |
|---|---|
| Rubble masonry in mortar in river retaining walls, 36,397 cubic yards, at $5 | $181,985.00 |
| Rubble masonry in mortar in canal walls, lining portion in sand or gravel, 123,712 cubic yards, at $5 | 618,560.00 |
| Rubble masonry in mortar in special wall between canal and river between stations 27+50 and 31, 15,000 cubic yards, at $6 | 90,000.00 |
| Rubble masonry in mortar in special wall between canal and river near Celilo, between stations 431+50 and 443+70, 25,330 cubic yards, at $6 | 151,980.00 |
| Concrete lining bottom of canal in sand or gravel (1 foot thick), 39,872 cubic yards, at $7 | 279,104.00 |
| Protection of bottom of canal against upward pressure during high stages, between stations 296 and 360, by drains and relief valves | 2,500.00 |
| Riprap waste rock to revet exposed places along river side of canal in sand, 52,000 cubic yards, at 50 cents | 26,000.00 |
| Two sluice gates to flush canal, at $5,000 each | 10,000.00 |
| Timber fenders and lining in rock cuts | 25,000.00 |
| Protection of canal from drifting and blowing sand, reclaiming about 850 acres of sand and gravel by sand fences, grass, and trees, etc., at $40 per acre | 34,000.00 |
| Six foot swing bridges across canal to fisheries, at $1,000 each | 6,000.00 |
| One wagon swing bridge across canal, at $2,000 | 2,000.00 |
| Cost of Celilo lock, complete, exclusive of excavation for locks and quarters for lock hands (concrete at $7 per cubic yard and steel at 12 cents per pound) | 91,987.00 |
| Cost of middle lock near head of Five Mile Rapids, exclusive of excavation for lock and quarters for lock hands | 66,951.00 |
| Cost of tandem lock at Big Eddy, exclusive of excavation and quarters for lock hands | 284,495.00 |
| Shops, storehouses, tools, etc | 25,000.00 |
| Quarters for lock hands, 7 sets, at $2,500 each | 17,500.00 |
| Total | 3,224,069.55 |
| Engineering, inspection, and contingencies, 20 per cent | 644,813.91 |
| Total cost | 3,868,883.46 |

*Summary of cost.*

| | |
|---|---|
| Improvement of Three Mile Rapids (taken same as in the Harts's project) | $152,448.00 |
| Canal and locks between Celilo and Big Eddy | 3,868,883.46 |
| Land, rights of way at all points, and damage to fisheries and railroad | 100,000.00 |
| Total | 4,121,331.46 |

The Board desires to express its high appreciation of the able, energetic, and satisfactory manner in which Major Langfitt has performed the work requested of him.

Respectfully submitted.

W. H. HEUER,
*Lieut. Col. Corps of Engineers.*
W. L. MARSHALL,
*Major, Corps of Engineers.*
EDW. BURR,
*Major, Corps of Engineers.*
CASSIUS E. GILLETTE,
*Captain, Corps of Engineers.*
C. H. MCKINSTRY,
*Captain, Corps of Engineers.*

## REPORT OF MAJ. W. C. LANGFITT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., October 12, 1903.*

COLONEL: I have the honor to submit the following report on survey for continuous canal between Celilo, Oreg., and Big Eddy, Columbia River, submitted in compliance with first indorsement, dated Office Chief of Engineers, May 23, 1903, on letter of the Board, dated May 14, 1903.

The information desired by the Board is contained in the following extract from this letter:

> The Board accordingly requests that Major Langfitt be instructed to make a detailed survey of the ground on which this canal would be located, to select the best or final line for the canal, and to make a detailed estimate of the cost of constructing it, with such plans of important elements of the project as will be required for said estimate. The right of way that would have to be acquired should be indicated on the map, and the cost of right of way and of any damages to private interests should be estimated as closely as possible. The canal should be taken as 65 feet wide at bottom and 8 feet deep; the locks, as 40 feet wide and 250 feet long between hollow quoins, with 7 feet of water on the miter sills.

*Survey.*—To obtain this information and make the estimates required practically a new survey throughout the whole length of the proposed route was necessary. The beginning of the field work was somewhat delayed by high water, but it was finally completed September 11, 1903. The maps, estimates, etc., were completed this date.

The topography of the ground in the vicinity of the proposed canal was carefully taken and the most suitable line was run in the field. Cross sections were taken at varying distances apart, depending on character of ground, but never more than 100 feet, for the calculation of quantities. The line began at Big Eddy and the stations were numbered consecutively to Celilo. In the rocky stretch from Big Eddy to the head of Five-mile Rapids, the cross sections were extended to comprise all the ground between the railroad and the river, as throughout this distance a choice of several alternate routes was possible. Above Five-mile Rapids the location was simpler.

The five river gauges located between Celilo and The Dalles, in about the same places as were the gauges used in the survey of 1879, were read daily, and for a part of the time three times a day during the continuance of the survey. The elevation of the water surface when the river is at the 38-foot stage at Cascade Locks (limit of practicable navigation) was carefully established, this being especially important, as it determines the height to which it is necessary to build the river retaining walls along the side of the canal. As confirming this reference as to limit of navigation, it may be noted that the two river steamers failed to reach Cascade Locks from below after several attempts on June 6, 1903, the river being at the 39.4-foot stage at the Cascades. The elevation of this line as now determined is about 4 feet higher than that shown on profile of Captain Hart's project. All elevations obtained were referred to the datum plane of survey of 1879. Enough borings were made in the sand and pits dug in the gravel to determine the nature of the foundation of the canal and walls.

*General description of proposed line.*—The route finally selected, and on which the estimate herewith is based, commences in the rock on the Oregon shore at a point just below Big Eddy and runs along the rocky ground between the railroad and the river. At the head of

Five-mile Rapids it passes into sand and gravel for a distance of about 12,400 feet, where rock is again encountered and through which it continues for about 7,900 feet until it enters the second stretch of sand and gravel at the "Willows." At the head of Ten-mile Rapids, about 6,400 feet above the "Willows," the line strikes the basalt again and keeps on between the Oregon Railroad and Navigation Company's track and the river until finally the low place just below Celilo Falls is reached. Here it is proposed to wall off the canal from the river by a high masonry wall founded on rock. This special wall will form a large basin in the canal. From this basin the canal passes into the upper lock, and finally enters the river in the rock and gravel just above Celilo Falls. The total length of this line will be about 45,000 feet. It will not destroy any of the existing fish wheels or seining grounds, but means of access to them over the canal are provided for in the estimate. Neither will the proposed canal necessitate any diversion of the Oregon Railroad and Navigation Company's tracks, but a retaining wall will probably be required along the railroad embankment for about 1,000 feet between stations Nos. 61 and 71, where the canal hugs it near the head of Five-mile Rapids.

*Passing places.*—Throughout the length of the canal, and situated about one mile apart, basins are provided for of sufficient size to admit of boats passing one another. In order to save excavation in their construction, where possible, these chambers are to be formed by widening the canal where the ground is already more or less below grade.

*Curvature.*—The minimum curvature adopted, except at unusually wide places, is limited to a radius of 955 feet, and boats that can pass through the locks should have no great difficulty in making fair speed.

*Elevations and water levels.*—From data obtained from survey of 1879, adopted extreme low water at the lower end of the canal is found to be at reference (9) and the elevation of the same stage immediately above Celilo Falls is at reference (89), a difference of 80 feet.

As the canal is to obtain its water supply from the Columbia River immediately above Celilo Falls, the elevation of the water level in the canal at extreme low water can not exceed reference (89), and as it is desirable to keep the canal as high as possible in the upper portion to reduce the height of the river retaining walls, reference (89) is adopted for the elevation of the water surface at extreme low water from Celilo to a short distance below the head of Five-mile Rapids, a distance of about 7 miles. Here a single lock drops the elevation to reference (78), which is carried until it is brought down by the tandem locks at the lower entrance to the level of the river at the foot of Big Eddy. The walls of the upper line of the canal and the middle lock are raised sufficiently so that an elevation of the water surface to reference (93) may be allowed between the Celilo and Middle locks. This is chiefly to counterbalance a possible upward pressure under the bottom lining of the canal where it is situated in porous sand or gravel, which would otherwise be caused when the river approaches the limit of navigation by percolation through the permeable foundation. This arrangement also obviates the necessity of lockage at the upper entrance until the river at Celilo is above reference (93), and at the same time gives an increase of depth a large part of the time in the long upper level.

*Flooding of canal.*—The average summer high waters of the Columbia River will completely overflow the canal. To regulate the entrance of the flood water as the river reaches the stage of 38 feet at Cascade locks, so that it shall not come over the walls toward its upstream end first, the slope of the river retaining walls is made somewhat greater than that of the water surface corresponding to this 38-foot stage, thus allowing the flood water to enter the canal first at the lower end of both sections.

*Sluiceways.*—For the purpose of sluicing out of the canal into the river any sand or river sediment which may become deposited in it, two openings, closed with suitable steel gates, are provided in the rock or river walls, one near Ten-mile Rapids and the other just below the head of Five-mile Rapids.

*Locks.*—The elevation of the river surface just above Celilo Falls rises to reference (106.3) when the stage is 38 feet at Cascade locks. The plan provides for a lock at the upper entrance, just above Celilo Falls, with a capacity of lift of 17 feet to pass boats between the canal and river until the limit of navigation is reached. Another lock is to be situated just below the head of Five-mile Rapids, with a lift of 11 feet. At the lower entrance is to be a tandem lock to overcome a total lift of 69 feet at times of extreme low water, each lock to have a lift of 34½ feet. All the locks are to be 40 feet wide and capable of passing boats 250 feet long.

The locks were designed by Mr. Chas. F. Walthers, assistant engineer, who has also made the estimate of their cost. They are to be of concrete with steel gates, and are all founded in the solid basaltic rock. The valves are of the cylindrical type, and the gates are designed to be opened and closed by hand by rack and pinion.

*Canal lining.*—Where the canal is situated in sand or gravel it is proposed to line it on the sides with masonry walls in mortar, 2 to 3 feet wide on top, with batter on one side of 2 on 1. The bottom is to be lined with concrete 1 foot thick. Lining was not thought necessary for sections in solid rock. As a relief against possible upward hydrostatic pressure on the concrete bottom of the canal at stage of the river approaching the limit of navigation in that stretch of the canal next above Ten-mile Rapids, two rows of 6-inch diameter tile drain pipe are to be laid under the concrete with T joints and iron weep valves at intervals opening into the canal.

*Walls.*—Where situated on rock the walls are designed to be of rubble masonry in mortar, and to be carried up at least 2 feet above either the water level in the canal or the level of the river outside at the limit of navigation. All walls are given an ample factor of stability against any possible pressure to which they may be subjected. A high wall, as already stated, is required just below Celilo Falls. It will be about 1,200 feet long and founded on rock at low water by building a low cofferdam. The foundation of this wall is not expected to be below reference (58) at any point, and its top is to be at reference (106). A shorter special wall opposite station 27+50 to station 31 will have to be as high as 80 feet in one place to reach a rock foundation. Both of these special walls are itemized separately in this estimate.

*Protection of canal where it leaves the rock and passes into the sand, especially just above Five-mile Rapids and Ten-mile Rapids.*—At Five-mile Rapids it is proposed to carry the outside lining wall down from 20 to 24 feet to rock or gravel foundation. The sand between the canal and river will be thoroughly riprapped, and in the most exposed places hand paved with waste rock from excavations. For purposes of estimate the outside wall was carried down below the canal bottom its full width, but without batter. This gives a stronger wall than is necessary for a core wall only, and yet hardly strong enough for a retaining wall if all the sand on the outside of it should be washed away. It is believed that the riprapping will prevent this, especially as there is but little, if any, current at higher stages when the river reaches or covers the protection.

The part of the canal where it leaves the rock just above Ten-mile Rapids is also in sand of very great but unknown depth, but it is thought that the canal can be made secure by riprapping and paving the river bank in the manner just described. The canal, for the few hundred feet where these conditions exist, could of course be supported on a grillage founded on piles, but estimate on this plan was not made. The current of the river at both of these places is checked at high stages by the gorges at Ten-mile and Five-mile Rapids, and at low stages the walls are completely uncovered.

The other two places where the canal leaves the rock and enters the sand are at greater distance from the river, and can be protected with a less amount of ordinary riprap.

*Wooden lining and fenders.*—That part of the canal in rock cuts of considerable height was estimated to have 1 foot extra of rock removed from each side and to be lined with heavy wooden fenders fastened at intervals to the rock.

*Protection of the canal against blowing and drifting sand.*—The rapid drifting of the sand under the influence of the violent winds which prevail, especially in the spring and autumn, if not controlled will be a serious obstacle to maintenance of the canal throughout the two sand and gravelly stretches. The test pits dug during the survey filled very rapidly with sand. It is thought, however, that by irrigating the sand by means of movable pumps, taking water from the canal itself, that the greater part, or at least a wide strip on each side of the line, can be reclaimed and support a growth of grass, bushes, and willows, and thus arrest the sand movement into the canal. The total area of the sand between the railroad and river does not exceed 850 acres, which it would seem possible to take care of for a reasonable expense.

*Dimension of canal prism.*—The canal prism is taken at 65 feet wide on the bottom, and in figuring the quantities a slope of 4 on 1 was allowed for rock cuts, and in the sandy portion a proper allowance was made for extra excavation for side walls and concrete lining. The canal is designed to be 8 feet deep at low water, with 7 feet over the miter sills. A grade of about 1 foot is given the bottom between the Celilo and Middle locks.

*Prices.*—In making the estimate the unit prices as fixed by the Board were used. One dollar per cubic yard, however, was added to the cost of the two high masonry walls, to cover extra expense in founding them.

*Accessories.*—Among the accessories, 7 sets of quarters for lock hands were included, also storehouses and tools and a swing footbridge at every fishery isolated by the canal, as well as one wagon bridge leading to Seufert Brothers' seining ground, just below Tum Water.

*Drawings.*—The following drawings have been prepared, viz: A

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $10,912.20 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 3,420.66 |
| July 1, 1904, balance unexpended | 7,491.54 |
| July 1, 1904, outstanding liabilities | 155.00 |
| July 1, 1904, balance available | 7,336.54 |
| Amount (estimated) required for completion of existing project | 229,260.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement, in addition to the balance unexpended July 1, 1904 | 100,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897. | |

APPROPRIATIONS.

| Act of— | |
|---|---|
| August 14, 1876 | $90,000 |
| June 18, 1878 | 150,000 |
| March 3, 1879 | 100,000 |
| June 14, 1880 | 100,000 |
| March 3, 1881 | 100,000 |
| August 2, 1882 | 265,000 |
| July 5, 1884 | 150,000 |
| August 5, 1886 | 187,500 |
| August 11, 1888 | 300,000 |
| September 19, 1890 | 435,000 |
| July 13, 1892 | 326,250 |
| March 3, 1893 | $1,239,653 |
| June 3, 1896 | 50,000 |
| June 11, 1896 | 179,597 |
| March 3, 1899 | 75,000 |
| June 13, 1902 | 30,000 |
| January 5, 1903, deposited to credit of appropriation, account sales | 6,100 |
| Total | 3,784,100 |

## U U 12.

## OPERATING AND CARE OF CANAL AND LOCKS AT THE CASCADES OF THE COLUMBIA RIVER, OREGON.

The canal and locks around the Cascades of the Columbia River, about 150 miles above the mouth of the latter in the Pacific Ocean, and which, although incomplete, enable steamboats drawing 8 feet to run as far upstream as The Dalles, Oreg., about 200 miles above the mouth, were formally opened to navigation November 5, 1896.

### OPERATIONS DURING THE FISCAL YEAR 1904.

During the past fiscal year the locks have been continuously operated. The only work in progress during the year, aside from the regular work of operating and caring for the locks and grounds, consisted in making repairs to the wing wall on the north side of the lower entrance to the canal, in finishing the waiting room which was commenced the previous year, and in making minor repairs to quarters.

The high water of 1903 has caused some damage to this protection wall by washing the spalls from the joints of the pavement on the canal side. It was considered best to make these repairs from available funds instead of dredging in the canal entrances, as the boats using the canal experienced no difficulty, the high water remaining at a good stage during the whole year. The recommendation that this work be done was approved and repairs were completed during March, 1904, the voids all being filled up with concrete and cement mortar.

Soundings taken in the fall of 1903 show that probably no dredging will be required in the lower entrance to the canal, but in the upper entrance the soundings show a deposit of from 3 to 5 feet above low water.

The work has been under the immediate supervision of Mr. W. L. Clark, inspector.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,028.36 |
| Amount allotted July 8, 1904, from indefinite appropriation | 5,000.00 |
| | 7,028.36 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 5,090.87 |
| July 1, 1904, balance unexpended | 1,937.49 |
| July 1, 1904, outstanding liabilities | 436.00 |
| July 1, 1904, balance available | 1,501,49 |

ALLOTMENTS.

| | | | |
|---|---|---|---|
| November 4, 1896 | $2,500.00 | July 25, 1900 | $11,121.41 |
| May 21, 1897 | 350.00 | July 19, 1901 | 2,243.63 |
| August 21, 1897 | 4,000.00 | July 12, 1902 | 5,500.00 |
| October 30, 1897 | 1,500.00 | July 8, 1903 | 5,000.00 |
| July 26, 1898 | 13,869.36 | | |
| July 22, 1899 | 3,047.77 | Total | 49,132.17 |

*Detailed statement of expenditures for operating and care of canal and locks, Columbia River, Oregon, during the fiscal year ending June 30, 1904.*

| Month. | Labor. | Materials for repairs. | Tools, fuel, oil, etc. | Office expenses, superintendence, and contingencies. | Total. |
|---|---|---|---|---|---|
| 1903. | | | | | |
| July | $35.00 | $230.90 | | | $265.90 |
| August | 206.00 | 83.84 | $0.75 | | 290.59 |
| September | 190.00 | 3.95 | 5.30 | | 199.25 |
| October | 194.50 | 276.50 | 78.95 | $5.65 | 555.60 |
| November | 193.00 | 486.75 | | | 679.75 |
| December | 225.50 | 118.13 | 10.00 | | 353.63 |
| 1904. | | | | | |
| January | 263.75 | 63.99 | | | 327.74 |
| February | 585.50 | 31.18 | | | 616.68 |
| March | 422.75 | | | | 422.75 |
| April | 543.50 | 4.74 | 1.25 | 1.25 | 550.74 |
| May | 196.00 | 13.99 | 20.50 | | 230.49 |
| June | 245.25 | | 2.50 | 350.00 | 597.75 |
| Total | 3,300.75 | 1,813.97 | 119.25 | 356.90 | 5,090.87 |

*Summary of expenditures made on operating and caring for canal and locks, Columbia River, Oregon, during the fiscal year ending June 30, 1904, submitted in compliance with river and harbor act of July 5, 1884.*

| Items of estimate. | Amount. |
|---|---|
| Labor | $3,300.75 |
| Materials for repairs | 1,313.97 |
| Tools, fuel, oil, etc | 119.25 |
| Office expenses, superintendence, and contingencies | 356.90 |
| Total | 5,090.87 |

## COMMERCIAL STATISTICS.

*Canal at Cascades, Oregon—Summary of business, etc., during fiscal year ending June 30, 1904.*

| Month. | Average gauge readings, 12 m. | | Number of lockages. | Locks operated. | | Number of passages. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Upper. | Lower. | | | | Stern-wheel. | Propeller. | Barge or sail. | Total. |
| 1903. | | | | *h.* | *m.* | | | | |
| July | 115.5 | 101.2 | 104 | 31 | 20 | 103 | 1 | ........ | 104 |
| August | 106.1 | 87.9 | 103 | 17 | 10 | 102 | ........ | 1 | 103 |
| September | 102.3 | 81.6 | 115 | 19 | 10 | 115 | ........ | ........ | 115 |
| October | 102.6 | 81.9 | 143 | 23 | 50 | 143 | ........ | ........ | 143 |
| November | 101.6 | 80.3 | 119 | 19 | 50 | 118 | 1 | ........ | 119 |
| December | 100.8 | 79.3 | 82 | 13 | 40 | 82 | ........ | ........ | 82 |
| 1904. | | | | | | | | | |
| January | 99.2 | 76.9 | 53 | 8 | 50 | 52 | 1 | ........ | 53 |
| February | 99.0 | 76.8 | 50 | 8 | 20 | 50 | ........ | ........ | 50 |
| March | 103.7 | 84.2 | 54 | 9 | 00 | 54 | ........ | ........ | 54 |
| April | 112.4 | 96.6 | 60 | 11 | 45 | 60 | ........ | ........ | 60 |
| May | 119.8 | 106.5 | 73 | 17 | 55 | 72 | 1 | ........ | 73 |
| June | 121.4 | 107.9 | 90 | 22 | 35 | 90 | ........ | ........ | 90 |
| Total | ........ | ........ | 1,046 | 203 | 25 | 1,041 | 4 | 1 | 1,046 |

| Month. | Registered tonnage. | Freight carried. | Passengers. |
|---|---|---|---|
| 1903. | | *Tons.* | *Number.* |
| July | 38,618 | 3,002.75 | 9,676 |
| August | 38,767 | 1,842.25 | 10,962 |
| September | 38,316 | 4,320.00 | 12,615 |
| October | 46,501 | 6,820.75 | 8,360 |
| November | 39,021 | 4,322.00 | 6,330 |
| December | 27,549 | 2,084.75 | 5,462 |
| 1904. | | | |
| January | 16,416 | 1,083.25 | 2,084 |
| February | 13,765 | 1,323.50 | 1,686 |
| March | 12,090 | 1,620.00 | 2,158 |
| April | 18,230 | 1,619.75 | 3,282 |
| May | 27,621 | 1,872.00 | 4,538 |
| June | 36,508 | 2,002.50 | 9,844 |
| Total | 358,397 | 31,913.50 | 76,971 |

*Statement of traffic passing through canal at the Cascades, Oregon, during fiscal year ending June 30, 1904.*

### BOUND UP.

| Month. | Coal. | Flour. | Miscellaneous grain. | Hay. | Cattle. | Horses. | Sheep. |
|---|---|---|---|---|---|---|---|
| 1903. | *Tons.* | *Pounds.* | *Pounds.* | *Tons.* | *Number.* | *Number.* | *Number.* |
| July | ........ | ........ | 4,000 | 5.00 | 21 | 111 | ........ |
| August | ........ | ........ | 20,000 | ........ | 7 | 57 | 41 |
| September | 326 | 3,100 | 10,500 | 28.25 | 30 | 112 | ........ |
| October | ........ | 1,000 | 20,000 | 114.25 | 29 | 158 | 3 |
| November | 290 | 1,000 | 45,500 | 49.25 | 79 | 100 | 150 |
| December | ........ | ........ | 47,500 | 60.50 | 22 | 61 | ........ |

*Statement of traffic passing through canal at the Cascades, Oregon, etc.*—Continued.

BOUND UP—Continued.

| Month. | Coal. | Flour. | Miscellaneous grain. | Hay. | Cattle. | Horses. | Sheep. |
|---|---|---|---|---|---|---|---|
| 1904. | *Tons.* | *Pounds.* | *Pounds.* | *Tons.* | *Number.* | *Number.* | *Number.* |
| January |  | 9,000 | 85,000 | 33.50 | 14 | 65 |  |
| February |  | 4,000 | 29,500 | 35.25 | 6 | 61 |  |
| March |  | 4,000 | 26,500 | 62.75 | 26 | 117 | 92 |
| April |  |  | 18,000 | 21.50 | 37 | 129 | 49 |
| May |  | 4,000 | 6,000 | 9.00 | 130 | 121 |  |
| June |  | 2,000 | 2,000 | 12.00 | 68 | 145 |  |
| Total | 616 | 28,100 | 314,500 | 431.25 | 464 | 1,237 | 335 |

| Month. | Miscellaneous live stock. | Wool. | Berries and fruit. | Lumber. | Miscellaneous merchandise. | Total cargo. | Passengers. |
|---|---|---|---|---|---|---|---|
| 1903. | *Number.* | *Pounds.* | *Pounds.* | *Ft. B. M.* | *Tons.* | *Tons.* | *Number.* |
| July |  |  |  |  | 717.00 | 803.75 | 4,819 |
| August | 100 |  |  | 4,565 | 668.50 | 731.50 | 5,096 |
| September | 9 | 27,500 | 25,900 | 3,200 | 687.50 | 1,170.50 | 6,105 |
| October | 133 |  | 1,000 | 1,200 | 681.50 | 930.75 | 4,112 |
| November |  |  | 10,750 | 7,130 | 656.50 | 1,144.75 | 2,782 |
| December | 31 |  | 1,000 | 330 | 419.75 | 557.00 | 2,573 |
| 1904. |  |  |  |  |  |  |  |
| January |  |  |  | 800 | 286.00 | 415.25 | 969 |
| February |  |  |  | 9,830 | 376.00 | 484.00 | 821 |
| March |  |  |  | 4,800 | 577.50 | 758.50 | 1,163 |
| April |  |  |  | 10,680 | 715.00 | 863.00 | 1,857 |
| May |  |  |  | 14,500 | 819.25 | 995.50 | 2,767 |
| June |  |  |  |  | 897.25 | 1,082.75 | 4,887 |
| Total | 273 | 27,500 | 38,650 | 57,085 | 7,501.75 | 9,882.25 | 37,921 |

BOUND DOWN.

| Month. | Wheat. | Flour. | Miscellaneous grain. | Hay. | Cattle. | Horses. | Sheep. | Miscellaneous live stock. |
|---|---|---|---|---|---|---|---|---|
| 1903. | *Pounds.* | *Pounds.* | *Pounds.* | *Tons.* | *Number.* | *Number.* | *Number.* | *Number.* |
| July | 2,912,275 | 267,500 | 198,000 | 5.50 | 69 | 259 | 2,081 | 62 |
| August | 899,500 | 127,000 | 197,500 |  | 5 | 195 | 78 | 30 |
| September | 3,860,000 | 76,500 | 137,000 |  | 183 | 288 | 4,417 | 126 |
| October | 8,671,000 | 581,500 | 134,500 |  | 526 | 308 | 2,223 | 705 |
| November | 3,289,000 | 479,500 | 226,000 |  | 334 | 271 | 6,898 | 175 |
| December | 1,818,000 | 96,000 | 352,000 | 10.25 | 60 | 196 |  | 240 |
| 1904. |  |  |  |  |  |  |  |  |
| January | 86,000 | 437,500 | 481,000 |  | 9 | 111 |  | 54 |
| February | 166,000 | 381,500 | 417,500 |  | 26 | 124 | 310 |  |
| March | 313,500 | 419,500 | 216,500 |  | 75 | 75 | 1,070 |  |
| April | 70,000 | 274,000 | 375,000 |  | 15 | 158 | 241 | 51 |
| May | 93,000 | 285,500 | 329,000 |  | 59 | 336 | 1,318 | 135 |
| June | 96,000 | 158,000 | 357,000 |  | 165 | 600 | 200 | 160 |
| Total | 22,224,275 | 3,584,000 | 3,421,000 | 15.75 | 1,526 | 2,916 | 18,836 | 1,738 |

| Month. | Wool. | Berries and fruit. | Lumber. | Miscellaneous merchandise. | Total cargo. | Passengers. |
|---|---|---|---|---|---|---|
| 1903. | *Pounds.* | *Pounds.* | *Feet B. M.* | *Tons.* | *Tons.* | *Number.* |
| July | 500 | 16,000 | 21,900 | 156.50 | 2,199.50 | 4,857 |
| August | 54,000 | 249,000 | 17,060 | 190.25 | 1,109.00 | 5,856 |
| September | 219,000 | 242,000 | 48,960 | 322.50 | 3,154.25 | 6,510 |
| October | 800 | 138,800 | 166,200 | 258.00 | 5,989.75 | 4,238 |
| November |  | 120,900 | 37,450 | 394.50 | 3,177.75 | 3,538 |
| December |  | 10,500 |  | 208.75 | 1,528.25 | 2,889 |
| 1904. |  |  |  |  |  |  |
| January |  | 23,000 | 10,800 | 59.25 | 668.00 | 1,095 |
| February |  | 9,500 | 10,460 | 230.25 | 839.00 | 874 |
| March |  | 68,500 |  | 221.25 | 866.50 | 990 |
| April |  | 20,500 |  | 268.50 | 757.25 | 1,425 |
| May |  | 1,000 |  | 206.75 | 876.00 | 1,771 |
| June |  | 18,500 |  | 176.50 | 970.25 | 5,007 |
| Total | 274,300 | 912,700 | 307,820 | 2,698.00 | 22,085.50 | 39,050 |

This stretch of the Columbia River is now being improved under a project having for its object the providing of sufficient depth over the bar below Vancouver to permit ascending vessels drawing 20 feet or more to reach that city, to be accomplished by the construction of a dike from the Oregon shore to the head of Hayden Island, opposite the town.

In the opinion of Major Langfitt, as stated in his report of July 22, 1902, a 15-foot channel 150 feet wide will be ample for all needs of commerce for some time to come, and he states that the excavation of such a channel would cost $15,000, and would require $3,000 annually for its maintenance. He estimates the cost of a permanent dike to aid in obtaining and maintaining this channel at $30,000. He believes, however, that the demands of present and prospective commerce will not warrant these expenditures at the present time, but that the dike already constructed should be maintained in good repair at a cost of $5,000 annually. These views are concurred in by the division engineer, Lieut. Col. W. H. Heuer, Corps of Engineers. In his supplemental report, dated August 1, 1903, Major Langfitt presents a plan for providing a channel 150 feet wide and 20 feet deep at low water, which is estimated to cost—

| | |
|---|---|
| For dredging | $60,000 |
| For deflecting dikes | 110,000 |
| For maintenance (annually) | 10,000 |

including $5,000 for repairs to the Hayden Island dike, and $5,000 for dredging.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, as provided by sections 3 and 14 of the above-mentioned act; the locality has been visited by a committee of the Board, and a public hearing has been held at Vancouver at which interested parties appeared in advocacy of the improvement. Attention is invited to the Board's reports of July 7 and August 31, 1903, herewith, and I concur in the conclusions of the Board expressed in its report of August 31, 1903, as follows:

> The Board accordingly recommends that the project for the improvement of the Columbia River, between Vancouver and the mouth of the Willamette River, be modified to cover the dredging of a channel 150 feet wide and 20 feet deep on the line proposed in the district officer's accompanying report, or such other line as conditions existing at the time the work is begun indicate to be advisable, at a cost of $60,000, and the maintenance of said channel and of the dike at the head of Hayden Island, at a cost of $10,000 annually.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

HON. ELIHU ROOT,
*Secretary of War.*

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## REPORT OF CAPT. W. C. LANGFITT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
*Portland, Oreg., July 22, 1902.*

GENERAL: In compliance with Department letter dated July 11, 1902, I have the honor to submit the following report upon an examination of that portion of the Columbia River between Vancouver, Wash., and the mouth of the Willamette, with a view to ascertaining the effects of the dikes and other works between the points named, in accordance with river and harbor act approved June 13, 1902.

The project of improvement of the above-named portion of the Columbia River was approved in 1892, and provides for increasing the depth over a shoal about 2¼ miles below the town of Vancouver from 9 feet to about 20 feet at extreme low water by closing the head of Oregon Slough by a dike extending from the Oregon shore to the head of Hayden Island, at an estimated cost of $100,000.

At extreme low-water stage nearly one-third of the flow of the Columbia River originally passed through the slough, and it was thought that by diverting the larger part of this into the main channel of the river the latter would be considerably deepened.

The dike was nearly completed in 1893. A subsequent rise in the river washed away the head of Hayden Island and allowed about the same volume of the river as formerly to pass down the slough. In 1897–98 the dike was finally completed and joined the head of Hayden Island. As finished it is nearly a mile long, with two cross dikes connecting the downstream end with the head of the island, which is well revetted with brush and stone. The elevation of the top of the dike built in 1892–93 is 4 feet above low water, while that part built in 1897–98 is nearly 3 feet higher. Last winter the dike and revetment were placed in excellent repair by the expenditure of an allotment of $8,000.

The work was evidently designed to produce its greatest effect during low or medium stages.

Toward the end of the low-water period last winter, from December 26 to 31, 1901, a survey of the portion of the river comprising the shoals between Vancouver and the mouth of the Willamette was made by Assistant Engineer J. S. Polhemus, a map[a] of which, plotted to a scale of 1:10,000, accompanies this report.

From this map it may be seen that the controlling shoals occur, one near the lower end of Hayden Island and the other about 1¼ miles upstream. In comparing this map with that of the previous survey made in 1899, not long after the completion of the dike, it may be observed that although the controlling depth over the shoals in question has been increased by the dike by only about 1 foot there has nevertheless been a very considerable scour. The area of water 18 feet in depth and over has been increased to a marked extent. The upper 18-foot curve extends farther downstream, and the deep pocket near the foot of the island bounded by the 18-foot curve is about twice as long and a little wider than it was in 1899.

The shoal 1¼ miles above the lower end of Hayden Island has at least 1 foot more water over it than formerly. The bar close in at the lower end of the island has 10 feet at the shoalest place in the channel at extreme low water as against 9 feet before the dike was built. The channel leading in a northerly direction from deep water just above the lower point of the island across the shoal in the middle of the river to deep water along the north bank has also deepened at least 1 foot and now has a minimum depth of 9 feet at extreme low water. This channel has moved downstream about 2,000 feet and was used during the last low-water period by the Hale & Kern loaded rock barges on their way to Grays Harbor.

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[a] Not printed.

It is thought that before any very appreciable gain in depth can be attained over the shoals in question it will be necessary to supplement the effect of the dike by dredging and perhaps by further permanent works. These latter may be either additional jetties or raising the height of the present dike or both. It is thought that at higher stages the caving of the banks has furnished any additional waterway needed, they being more easily attacked than the bottom.

It would seem, however, that by dredging alone a moderate increase of depth could be more easily and cheaply obtained and maintained.

The effect of the dike has unquestionably been to lessen the amount of material it would be necessary to remove to obtain the projected depth.

The commerce now using this portion of the river is amply accommodated with present depth with the exception of the stone barges used in carrying stone to Grays Harbor jetty by the contractors for that work. This contract, I believe, will soon be completed. Whether stone for Grays Harbor will again be obtained from the quarry now used is very questionable, and in any event an increase of three or four feet would probably be ample for the style of barges used, and prevent lighterage now necessary at low water.

To obtain a 20-foot channel, as contemplated by present project by dredging alone, would require the removal of approximately 200,000 cubic yards, at a cost of about $40,000. If a 15-foot channel 150 feet wide is adopted, and it is believed this will be ample for all needs for some time to come, 60,000 cubic yards will have to be removed, and the estimated cost is $15,000. To maintain this channel, probably an annual dredging would be necessary, and while the amount so required is extremely problematical, probably $3,000 would cover the annual cost.

A permanent dike to aid in obtaining and maintaining the 15-foot channel would probably cost $30,000.

On the whole it is not believed that the demands of the present or prospective commerce will warrant the expenditures at the present time, but the dike already constructed should be maintained in good repair and beyond possibility of failure. This can be done probably with an annual expenditure of about $5,000, but of course unforeseen emergencies may occur which would require a larger sum.

Further survey is not believed necessary at this time.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., July 25, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army.

The views of the district officer are concurred in.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 11, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

By command of Brigadier-General Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 7, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on the preliminary examination of "Columbia River [Washington], between Vancouver and the mouth of the Willamette, with a view to ascertaining the effects of the dikes and other works between the points named," the indorsement of the division engineer thereon, and other data available. On May 14, 1903, a committee of the Board made a personal inspection of the locality and held a public hearing in Vancouver, Wash. At this meeting various interested parties appeared in advocacy of the improvement.

The city of Vancouver is on the Columbia River, 5 miles above the mouth of the Willamette. Twenty feet of water or more is found along the water front of the city, and everywhere below the city, except on a long shoal lying about 2½ miles downstream, on which the original depth was about 9 feet and the present depth is about 10 feet. The existing project is to obtain 20 feet at low water through this shoal by means of a dike closing Oregon Slough, at an estimated cost of $100,000. The dike was completed in 1893, and repaired and extended in 1898 and 1902. Its total cost has been about $108,000. The effect of the dike has been to move an enormous quantity of sand from the shoal area, but the increase in channel depth has been but about 1 foot.

According to the statement furnished by the Commercial Club of the city of Vancouver the water-borne commerce of Vancouver for the calendar year 1902 exceeded 489,000 tons, of which the largest part was lumber (exported). Much the greater part of this commerce is carried on in light-draft vessels, considerable of the lumber being lightered over the shoal to vessels lying in the deep water downstream. During the summer rise, which amounts to a mean of 20 feet, and has been known to reach 30 feet, deep-draft vessels load at the Vancouver wharves.

A recent act of the legislature of the State of Washington authorizes the establishment within the State of river and harbor improvement districts, in which funds may be raised by local taxation and expended, among other purposes, for deepening navigable channels under the supervision of the War Department. At the public hearing referred to above, it was represented that it is the purpose of the people of

Vancouver to take advantage of this act to raise funds for the purpose of dredging a narrow channel, from 12 to 15 feet deep, through the shoal below Vancouver, for the immediate relief of that port.

The Board is of the opinion that in view of the present and reasonably prospective commerce of Vancouver it is advisable that the United States should undertake what further work may be necessary to secure a 20-foot channel through the shoal below Vancouver, provided the work can be done at a cost not greatly to exceed the preliminary estimate of the district officer as contained within, and recommends that the district officer be directed to prepare a final estimate of cost.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*July 11, 1903.*

Respectfully returned to Major Langfitt, who is directed to prepare the final estimate of cost recommended by the Board in third indorsement hereon.

* * * * * * *

To be returned.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Fifth indorsement.]

U. S. ENGINEER OFFICE,
*Portland, Oreg., August 1, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, report of this date accompanying.

W. C. LANGFITT,
*Major, Corps of Engineers.*

(Through the Division Engineer.)

[Sixth indorsement.]

UNITED STATES ENGINEER OFFICE,
NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., August 12, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, recommended for approval.

An examination of the map indicates that an alternative project for a dredged cut from the deep pocket south of △ Garden and extending in a northwesterly direction toward △ Palmer seemed feasible, and might eliminate the two expensive proposed dikes shown in the project submitted. On communicating with Major Langfitt on the subject, it was ascertained that he had given the alternative cut due consideration and rejected it, because comparison with previous surveys shows that the channel is improving along the line of the cuts which are proposed in the project submitted, which he considers favorable to maintenance at least cost, and that said channel is at present used by steamers. The alternative cut lies diagonally across the river and seems certain to fill readily. He also gave other reasons of less importance for rejecting the alternative cut.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 21, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors, with report containing final estimate as recommended.

By order of the Acting Chief of Engineers:

H. F. HODGES,
*Major, Corps of Engineers.*

[Eighth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., August 31, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The district officer estimates that to provide a channel 150 feet wide and 20 feet deep by dredging will cost $60,000, and to maintain it by dredging will cost $5,000 a year. As the outcome of an attempt to secure by dredging alone a deep channel in a river with shifting bed must always be a matter of uncertainty, the district officer submits an estimate of $110,000 for two dikes, to be built should experience show that the desired improvement is impossible of attainment by dredging alone. He refers to the fact that the building of these dikes may necessitate bank protection, but makes no estimate therefor.

Should it be found necessary to use on this stretch of river the contraction and protection works found necessary on alluvial streams of the most intractable kind, the sum of $170,000 (the aggregate of the estimates for dredging and dike work) would probably be inadequate; but the Board believes that in the present instance dredging at a cost of $60,000, and of $5,000 annually for maintenance, offers a reasonable prospect of attaining the end desired. It is also believed that the dike at the head of Hayden Island should be maintained, at least for some years to come; for which work the district officer estimates that $5,000 a year will be necessary. These expenditures are justified by the volume of present and prospective commerce.

The Board accordingly recommends that the project for the improvement of the Columbia River between Vancouver and the mouth of the Willamette River be modified to cover the dredging of a channel 150 feet wide and 20 feet deep on the line proposed in the district officer's accompanying report, or such other line as conditions existing at the time the work is begun indicate to be advisable, at a cost of $60,000, and the maintenance of said channel and of the dike at the head of Hayden Island, at a cost of $10,000 annually.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## PLAN AND ESTIMATE OF COST OF IMPROVEMENT OF COLUMBIA RIVER BETWEEN VANCOUVER, WASH., AND THE MOUTH OF THE WILLAMETTE RIVER.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., August 1, 1903.*

GENERAL: In compliance with instructions contained in fourth indorsement, dated Office Chief of Engineers, July 11, 1903, on report from this office, dated July 22, 1902, I have the honor to submit the following final estimate for the permanent improvement of the Columbia River between Vancouver, Wash., and the mouth of the Willamette River:

The last survey of this locality was made December, 1901, and the estimate is based on the results then obtained, which are believed to approximate sufficiently to the present conditions.

A map[a] of this survey, supplemented with the outline of a more extended survey made in November, 1899, is submitted herewith, and upon it is shown the approximate location of the proposed dredging and of two deflecting dikes. These, of course, should be changed as new surveys made before the work is started may show necessary.

The dredging is estimated as in sand for the most part, as indicated by the borings shown upon the map, and the quantities are based upon a channel 150 feet wide and 20 feet deep at low water. The price of 20 cents per cubic yard is named on the assumption that the material will have to be dredged and removed on scows. If either of the suction dredges belonging to the port of Portland can be obtained for this work, it is believed the dredging can be done for about half the price named. This can not be determined at the present time and it is not deemed advisable to consider this probability in the estimate.

The estimated cost of the work is as follows:

| | |
|---|---|
| Dredging upper shoal, 140,000 cubic yards, at 20 cents | $28,000 |
| Dredging lower shoal, 130,000 cubic yards, at 20 cents | 26,000 |
| Engineering, superintendence, and contingencies | 6,000 |
| Total | 60,000 |

Two deflecting dikes are included in this plan for permanent improvement, but these are to be built only in the event that the dredged channels fail to maintain themselves, or can not be maintained by annual dredging at a nominal cost. These dikes are to be of rubblestone on heavy brush mattress, and carried to height of 6 feet above low water; one to be 2,500 feet in length from the Washington shore above the upper dredged cut, and one 2,000 feet in length from the foot of Hayden Island.

The estimated cost of these dikes, including necessary shore protection, is as follows:

| | |
|---|---|
| Upper dike from Washington shore, 2,500 feet, at $20 per foot | $50,000 |
| Lower dike from foot Hayden Island, 2,000 feet, at $25 per foot | 50,000 |
| Engineering, superintendence, and contingencies | 10,000 |
| Total | 110,000 |

In the event of the construction of the upper dike, it is altogether probable that it would be found necessary to protect some portion, at least, of the lower half of Hayden Island along the channel bank on account of the increased current. This contingency is not included in the present estimate and is left for future development.

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[a] Not reprinted; printed in House Document No. 56, Fifty-eighth Congress, second session.

The existing dike at the head of Hayden Island should be annually maintained in good repair and beyond possibility of failure, and the proposed channels, when dredged, should also be maintained by annual dredging. The estimated cost of this annual maintenance is as follows:

| | |
|---|---|
| Repairs to Hayden Island dike | $5,000 |
| Dredging | 5,000 |
| Total | 10,000 |

The former estimate, which included the dredging of the upper shoal and a short cut across the sands at foot of Hayden Island into the south channel, which the proposed lower dike will close, was submitted to provide an immediate 20-foot channel at the least possible cost. For permanent improvement, however, the plan herein outlined is recommended.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

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## U U 15.

## PRELIMINARY EXAMINATION AND SURVEY OF UMPQUA RIVER, OREGON.

[Printed in House Doc. No. 810, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 28, 1903.*

SIR: I have the honor to submit herewith for transmission to Congress reports dated March 9 and October 22, 1903, by Maj. W. C. Langfitt, Corps of Engineers, upon preliminary examination and survey, respectively, of Umpqua River, Oregon, "with a view to ascertaining whether present needs of commerce require improvement at the mouth thereof," ordered by the river and harbor act approved June 13, 1902.

Major Langfitt stated in his report on preliminary examination that "if a sufficient improvement could be made for a moderate sum the locality could be reported as worthy," but that no definite plans or estimates could be submitted prior to the making of a survey. Such survey was accordingly authorized, and the report thereon contains a project for improvement necessary to obtain a channel 15 feet in depth from the town of Gardiner, 8 miles above the river's mouth, to deep water on the outer edge of the bar beyond the mouth, by the construction of a north and a south jetty and by dredging, at a cost of $621,431.32, and possibly of $271,131.80 additional for jetty work that might prove necessary to obtain the full depth and breadth of channel desired.

In the opinion of Major Langfitt the expenditure of so "large a sum as $622,000 can hardly be recommended at the present time," and in transmitting the survey report to this office the division engineer, Lieut. Col. W. H. Heuer, Corps of Engineers, expressed the opinion that the full amount of work estimated for in the project would be necessary to produce and maintain the required depth of water, making the total estimated cost $892,563.12; that the cost of the improvement is incommensurate with the benefits likely to be desired, and that, for the present at least, it is unnecessary and unworthy of being undertaken.

For similar reasons set forth in its report of December 10, 1903, herewith, the Board of Engineers for Rivers and Harbors, created by section 3 of the aforementioned act, believes that present needs of commerce do not require improvement at the mouth of the Umpqua River, and, therefore, that no work with this end in view should be undertaken by the United States at this time.

I concur in the views of the Board.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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## PRELIMINARY EXAMINATION OF UMPQUA RIVER, OREGON.

United States Engineer Office,
*Portland, Oreg., March 9, 1903.*

General: I have the honor to submit the following report on the preliminary examination of "Umpqua River, with a view to ascertaining whether present needs of commerce require improvement at the mouth thereof," as required by the river and harbor act of June 13, 1902, and letter from Office Chief of Engineers, dated June 23, 1902.

The following general description of the locality is taken from a similar preliminary report submitted by Capt. (now Major) W. L. Fisk, Corps of Engineers, under date of August 28, 1897, and printed in Report of the Chief of Engineers for 1898, pp. 2992-2994, inclusive.

The Umpqua River is the largest stream emptying into the Pacific between the Sacramento and Columbia rivers. It rises in the Cascade Mountains about 120 miles east of the coast, flows in a general northwesterly direction, and empties into the Pacific Ocean about 175 miles south of the mouth of the Columbia River.

The Umpqua River was one of the earliest gateways to the interior of Oregon, and it was through this valley that many of the early settlers and supplies found their way to the mining regions in the southwestern part of the State. The river is navigable only to the head of tide water, a distance of 26 miles, and above this point is little else than a mountain stream of successive shallow rock rapids, gravel shoals, and intervening pools.

The total drainage area of the river and its tributaries is about 4,000 square miles. The region tributary to the Umpqua supports a growth of valuable timber, and the upper valley is broad and fertile and well under cultivation.

On the tidal portion of the river there is practically no arable land, as the valley contracts and the river winds between high hills on either side, hence the industries of the section are confined largely to the production of lumber and canning of salmon.

The small village of Scottsburg, containing about 100 inhabitants, is situated at the head of navigation for river craft, and is the point of transfer from stage to steamer on the route to the mouth of the Umpqua.

Gardiner is the principal town of the lower Umpqua and is situated about 8 miles above the mouth, at the head of navigation for seagoing vessels.

Gardiner has a population of about 400, and is the manufacturing point of this section, having a sawmill with a capacity of 80,000 feet B. M. per day, a cannery with an output of 10,000 cases per year, and a creamery which in 1895 shipped 40,000 pounds of butter.

Smith River joins the Umpqua about 1 mile above Gardiner and is the principal tributary of this section.

The Umpqua, above the mouth of Smith River to the head of navigation, varies in width from 500 feet to one-half mile and has a depth of from 2 to 20 feet at time of low tide.

From the mouth of Smith River to the ocean the Umpqua widens out into an elongated bay or tidal estuary, varying in width from three-eighths to 1¼ miles and having a minimum depth of about 10 feet at low tide. This bay contains here and there a few marshy islands and quite an expanse of mud flats, bare at time of low water. The last 4 miles of bay are bounded on the east and south by a high rocky shore, a prominent indentation of which forms Winchester Bay, just inside the entrance. On the west and north between the bay and ocean is a broad sand spit, mostly bare of all vegetation, about 4 miles in length and 1 mile in width.

A group of sunken rocks, known as "Ork reef," lies in mid-channel between Winchester Bay and the north spit. This reef is bare at low water, but forms no serious obstruction, as it is well buoyed, and the channel to the west is about one-fourth mile in width and of ample depth.

The harbor throat proper is 900 feet wide at low tide, and has a minimum depth of about 30 feet, while at high water the width between shore lines is one-half mile or more.

On the south side of the entrance is a rocky reef, bare at low tide, which extends a short distance into the channel, but seems no serious menace to navigation.

The crest of the bar lies southwest of the entrance about 1 mile, and though influenced somewhat by ocean storms and river freshets, the average depth thereon is seldom less than 13 feet at low water. The distance between breakers on the bar is about 1,800 feet, and the 3-fathom curve is found about 2,000 feet each side of the crest. At times during the rainy season heavy freshets occur in the river, adding an immense volume of fresh water to the tidal discharge, which is usually more detrimental than beneficial to the entrance, in that the increased current scours away the sands of the north spit and deposits the same upon the bar. The mean range of tide on the bar is about 5 feet, or 6.2 feet above the Coast Survey datum of mean lower low water; hence the depth on the crest at mean high water is about 19 feet.

The tidal influence extends almost undiminished for a distance of 26 miles up the Umpqua to the foot of the rapids, and the tidal area of the stretch is about 10 square miles, giving an average discharge at the mouth of about 65,000 cubic feet per second.

No hidden dangers lie off the entrance to the river, and the coast for about 20 miles on either side is a sandy beach, behind which are sand dunes, those to the south of the entrance rising to considerable height, thus forming a conspicuous landfall for vessels.

A first-order light-house is situated on the heights about three-quarters of a mile south of the entrance, and a life-saving station is located on the north spit, about 1 mile above the mouth of the river.

Because of the slight variation in position and depth of this bar, the Umpqua River entrance has always been considered one of the safest on the coast, and comparison of the earliest known Coast Survey of 1854 with that of most recent date shows but little change and confirms this reputation.

Mr. D. B. Ogden, assistant engineer, visited the locality at my request, and the following extract is made from his report:

On February 17, through the courtesy of the Gardiner Mill Company, who extended me the use of their bar tug *Hunter*, I was enabled to take a number of soundings on the crest of the bar. According to the time and tides given by the Coast and Geodetic tables, soundings were made on the bar at about half tide, or 3 feet above mean lower low water. The minimum depths obtained on the crest was 14 feet, or reduced to mean lower low water, 11 feet.

The present shoal condition of the bar is no doubt due to a heavy freshet in the Umpqua, which occurred early in February, which it is claimed scoured away the sands of the north spit and made deposit on the bar. The tug *Hunter*, draft 11 feet, went aground on the bar at half tide in attempting to cross out a day or two after the freshet.

Other than a probable 2-foot decrease in depth, the position and condition of the bar at the present time is practically the same as that described in the report of the former examination.

The following are the commercial statistics of the river as furnished by the Gardiner Mill Company for the year ending December 31, 1902:

*Number of coastwise vessels arriving and departing.*

| | |
|---|---|
| Sail: | |
| Arrivals | 49 |
| Departures | 49 |
| Steam:[a] | |
| Arrivals | 120 |
| Departures | 120 |
| Total crossings over bar | 338 |

The schooners *Lily*, *Louise*, *Sadie*, *Dora Bluhm*, *Beulah*, *Lucy*, *Zampa*, and *Caroline* made regular trips to and from Gardiner for lumber cargoes to San Pedro and San Francisco. In addition to these, the schooners *San Buena Ventura* and *Maggie C. Russ* made one trip each to this port.

The maximum draft of vessels crossing out over the bar was 14½ feet. It was, however, impracticable to load to this draft during about four months of the year, the bar being too shoal to permit.

The stern-wheel steamer *Eva*, draft 2½ feet, made daily trips on the Umpqua River between Gardiner and Scottsburg, a distance of 20 miles, and also between Gardiner and the mouth of the Umpqua River, a distance of 9 miles. During the year the steamer *Eva* carried 5,847 passengers and 2,500 tons of freight.

The steam propeller *Juno*, draft 4 feet, made biweekly trips on Smith River, between Gardiner and Sulphur Springs, a distance of about 20 miles, and during the year carried 1,240 passengers and 1,500 tons of freight.

The steam propeller *Umpqua*, draft 3½ feet, made daily trips between Gardiner and North Fork of Smith River, a distance of about 15 miles, during about nine months of the year, and during that time carried (estimated) 1,250 passengers and 1,250 tons of freight.

The steam propeller *Hunter* (tug), draft 11 feet, made almost daily trips between Gardiner and the river entrance, crossing over the bar as the business of towing vessels required.

The following is an estimate of the business of the port for the year ending December 31, 1902:

*Receipts.*

| | | |
|---|---|---|
| General merchandise | tons | 2,750 |
| Agricultural implements | do | 25 |
| Cannery and creamery supplies | do | 100 |

---

[a] Tug *Hunter*.

*Shipments.*

| | | |
|---|---|---|
| Lumber | feet.. | 16,000,000 |
| Lath | M pieces.. | 2,600 |
| Cattle and hogs | tons.. | 500 |
| Grain | do... | 100 |
| Butter and cheese | do... | 30 |
| Leather | do... | 7 |
| Miscellaneous, fruits, etc | do... | 100 |

| | |
|---|---|
| Estimated value of imports | $150,000 |
| Estimated value of exports | 225,000 |

There are two salmon canneries at Gardiner, but neither was in operation during the year 1902 because of the low price of canned fish. During the year 1901 their output was 400 tons.

The following statistics were given by Captain Fisk in his report, showing the commerce of the locality for the calendar year ending December 31, 1896:

*Receipts.*

| | | |
|---|---|---|
| General merchandise | tons.. | 1,500 |
| Agricultural implements | do.... | 10 |
| Cannery supplies | do.... | 60 |

*Shipments.*

| | | |
|---|---|---|
| Lumber | feet.. | 10,000,000 |
| Lath | M.. | 2,000 |
| Salmon | tons.. | 350 |
| Grain | do.... | 125 |
| Cattle | do.... | 250 |
| Miscellaneous freight | do.... | 58 |

| | |
|---|---|
| Estimated value of imports | $103,500 |
| Estimated value of exports | $151,450 |

A comparison of these statistics with those quoted from Mr. Ogden's report shows that both imports and exports have very much increased in the six years from 1896 to 1902, the former practically 45 per cent and the latter 48½ per cent in values. It seems probable, also, that these values will continue to increase under present conditions but more slowly, presuming that the present general prosperity continues. The development would probably be accelerated with the improved facilities for commerce that a deeper and fixed channel over the bar would encourage. The same trouble is experienced here in winter as at all other of the ocean bars along the Oregon and Washington coasts, the delays to vessels by being bar bound forming a serious item of expense. In this connection attention is invited to letter, attached hereto as Appendix A, from Mr. O. B. Hinsdale, secretary of the Gardiner Mill Company, the only firm exporting lumber from the locality. Mr. Hinsdale gives statistics showing that 9 vessels during two years were bar bound six hundred and twelve days and estimates the losses thus incurred at $60,000, or $30,000 per year. With a deeper fixed channel across the bar a large part, but not all, of these delays, with the consequent loss, would have been avoided. It may be remarked here that except by stage of 40 miles over mountainous road the only outlet of the lower Umpqua commerce is by sea.

In view of the favorable showing made in the commerce of the Umpqua, it is thought that if a sufficient improvement could be made for a moderate sum the locality could be reported as worthy. The bar is naturally a good one, good rock, lumber, and piles can be obtained relatively cheaply, and circumstances, generally speaking, are very favorable to low cost of work. An examination of the Coast Survey map of 1885-86 would indicate that probably sufficient improvement could be obtained within reasonable limits of cost. No definite plans or estimates, however, can be submitted without a survey, the cost of which is estimated at $4,000.

It is therefore recommended that an allotment of this amount, $4,000, be made for the purpose of making the necessary survey.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement].

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., March 12, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army. Whether or not the river is worthy of improvement will depend largely upon the estimated cost of improvement. This can not be determined without a survey. It is recommended that $4,000 be allotted for a survey.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement].

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*March 20, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., March 26, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer and the indorsement of the division engineer thereon.

The commerce involved is at present not large, but it is growing, and in the opinion of the Board an increase in depth on the bar and in the river as far up as Gardiner, 8 miles, would result in a considerable increase of business.

The physical conditions at the mouth, particularly the comparative stability of the bar channel in depth and position, indicate that the improvement needed can probably be accomplished at reasonable cost; this, however, can only be determined by a survey.

In the opinion of the Board the improvement is one worthy to be undertaken by the United States, provided it can be made at reasonable cost. The Board therefore recommends that there be made an allotment of $4,000 for the necessary survey and estimate, as recommended by the district officer and division engineer, said survey and estimate to cover the improvement of the river to Gardiner.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 4, 1903.*

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Umpqua River, Oregon, authorized by the river and harbor act approved June 13, 1902.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT,
*April 7, 1903.*

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

J. C. CHURCHILL,
*Acting Chief Clerk.*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 12, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report of survey as recommended.

By order of the Acting Chief of Engineers:

H. F. HODGES,
*Major, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., December 10, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

In addition to the within report the Board of Engineers for Rivers and Harbors has considered the accompanying report of the district officer on a survey of Umpqua River, Oregon, "with a view to ascertaining whether present needs of commerce require improvement at the mouth thereof," and the indorsement of the division engineer upon the same.

The district officer submits a project for the improvement necessary to obtain a channel 15 feet in depth from the town of Gardiner, the principal port on the Umpqua River, 8 miles above its mouth, to deep water on the outer edge of the bar beyond the mouth of the river. He estimates the cost of this improvement at $622,000, and in addition thereto the sum of $271,131.80 for work that may prove necessary to obtain the full depth and breadth of channel desired. He states that the sum involved is larger than it was thought it would be at the time of submission of report on preliminary examination, at which time it seemed probable that perhaps very much less work would be sufficient for such improvement as the commerce involved would need. He further expresses the opinion that the expenditure of so large a sum as $622,000 can hardly be recommended at the present time.

The division engineer expresses the opinion that the full amount of work estimated for by the district officer will be necessary to produce and maintain the required depth of water, making the estimated cost somewhat in excess of $892,000; and, further, that the cost of the improvement is incommensurate with the benefits likely to be derived therefrom; and, therefore, for the present at least, the mouth of the Umpqua River is unworthy of improvement.

The country adjacent to the Umpqua is very sparsely settled. This river is entirely within the county of Douglas, whose whole population is reported to be 14,565. A liberal estimate of the total population within the area likely to be benefited by the desired improvement would not exceed 2,000.

The depth of 15 feet expected from the proposed improvement does not appear to be sufficient to meet the demands of commerce now carried by vessels along this coast. A depth of 20 feet is generally required.

In view of the foregoing, it is the opinion of the Board that the estimated cost of an adequate improvement at the mouth of the Umpqua River is entirely disproportionate to the probable commercial benefits that would result therefrom, and answering the question contained in the act, the Board believes that present needs of commerce do not require improvement at the mouth of the Umpqua River, and therefore no work with this end in view should be undertaken by the United States at this time, and the Board so recommends.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

## APPENDIX A.

### LETTER OF THE GARDINER MILL COMPANY.

GARDINER, OREG., *February 19, 1903.*

DEAR SIR: Referring to our recent conversation regarding the commerce of the Umpqua River, I have prepared the following data from the records here in our office, and I trust the items may be of some use to you in making up the report. The list of vessels gives the names, draft, number of trips made to this port, and the number of days bar bound during the years 1901 and 1902. This includes all of the vessels and all of their trips made during those two years:

| Name. | Draft. | | Year. | Number trips. | Days bar bound. |
|---|---|---|---|---|---|
| | *Ft.* | *in.* | | | |
| Schooner Lily | 12 | 6 | 1901 | 9 | 23 |
| | | | 1902 | 10 | 32 |
| Schooner Louise | 13 | 6 | 1901 | 8 | 45 |
| | | | 1902 | 7 | 62 |
| Schooner Sadie | 18 | 6 | 1901 | 7 | 37 |
| | | | 1902 | 8 | 55 |
| Schooner Lucy | 13 | 6 | 1901 | 7 | 50 |
| | | | 1902 | 7 | 34 |
| Schooner Beulah | 14 | 0 | 1901 | 5 | 74 |
| | | | 1902 | 5 | 32 |
| Schooner Zampa | 14 | 0 | 1901 | 3 | 85 |
| | | | 1902 | 1 | 4 |
| Schooner Dora Bluhm | 13 | 6 | 1901 | 1 | 26 |
| | | | 1902 | 6 | 23 |
| San Buena Ventura | 12 | 6 | 1902 | 1 | 4 |
| Schooner Caroline | 13 | 6 | 1902 | 3 | 26 |
| Total, 9 vessels | | | | 88 | 612 |

The average net loss per day for the above may be estimated at $100. This would give an average for the two years of something over $60,000, or $30,000 per year net loss for the above nine vessels. This loss estimate does not include or cover any loss sustained by the lumber or other interests by reason of the delay in shipments. This, as you know, is a very considerable item in any line of business, but as it is an item of loss which is very hard to definitely arrive at it has been omitted here. To illustrate this point more fully, I would say that we very often are compelled to refuse profitable orders for lumber in our Los Angeles office for the reason that we can not with any degree of certainty estimate when to count on the arrival in San Pedro of a cargo which may be ordered during the season when our bar is apt to be in a bad condition.

In this connection it may be unnecessary to note here that this loss of $30,000 per year to our vessels would alone pay the interest at 5 per cent on $600,000, which may in this case be taken as an estimate of the cost of a jetty which would give us deep water at all times on our bar. During the times in which our vessels were bar bound shipping at Coos Bay was practically unhindered except at times of very severe storms, and then only for a few days at a time. The bar at Coos Bay was formerly no better than ours, perhaps not so good on an average, but now it is a well-known fact that they have a fine, deep harbor at all times.

Experience has shown that we can not safely use a greater loading draft than 14 feet, and this is the maximum to which we load the vessels now engaged in this bay. This light draft naturally restricts us to trade with domestic ports alone, as vessels for suitable draft for foreign trade can not cross out over our bar when loaded. It is a well-known fact that our domestic ports are usually comparatively poor markets for lumber products on account of the great supply which of necessity must be marketed in them. The commerce of our valley is therefore governed to a very great extent by the conditions of trade in California ports, those being practically the only markets we have for our lumber. This condition naturally retards the growth of business generally, whereas if we had free access to all markets, as Coos Bay and other deep-water harbors along the coast, trade would increase many fold.

At present a heavy growth of timber covers practically the whole of the Umpqua River water front. As this timber is taken from the land agricultural developments will take the place of logging interests, and most of the land will then be used for grazing, fruit growing, and general farming purposes, the climate being particularly favorable for stock raising and dairy business.

The timber tributary to this river may be estimated as covering 100 townships, or about two and one-quarter millions of acres of Oregon's best timbered land. The average annual export of lumber from this port is about 15,000,000. This amount could, under conditions encouraged by deep water on our bar, be increased to 50,000,000 or 75,000,000.

If I can be of any further assistance to you in this matter, please call upon me at any time. We are, of course, very much interested in having some improvement made on our bar, and want to do all we can to help the good work along.

With kindest regards, I remain,

Respectfully,

O. B. Hinsdale.

Mr. David B. Ogden,
*Assistant U. S. Engineer.*

## SURVEY OF UMPQUA RIVER, OREGON.

United States Engineer Office,
*Portland, Oreg., October 22, 1903.*

General: In compliance with letter from the Office of the Chief of Engineers dated April 10, 1903, I have the honor to submit the following report on a survey of the mouth of the Umpqua River, Oregon, together with a project of improvement of the river to Gardiner, with estimate of cost.

The survey was made in August, 1903, and a tracing[a] showing the results and outlines of a project for the improvement of the bar accompanies this report.

### GENERAL DESCRIPTION.

The Umpqua River is the largest stream emptying into the Pacific Ocean between the Sacramento and Columbia rivers. It rises in the Cascade and Calapooia mountains, about 120 miles east of the Oregon coast line, and flows in a general northwesterly direction, finally emptying into the ocean about 175 miles south of the Columbia River. It drains, with its tributaries, an area of approximately 4,000 square miles, subject to a moderately heavy rainfall, and in the winter and spring months freshets of considerable volume occur.

The tidal influence extends practically undiminished from its mouth at the ocean to Scottsburg, a distance of about 25 miles; above which point the river partakes of the nature of a rapid mountain stream, with numerous small falls, rapids, and swift water between pools. The principal tributary in the tidal portion is Smith River, which joins it about 10 miles above its mouth. Between Scottsburg and the mouth of Smith River the Umpqua varies in width from 500 feet to one-half mile, and in depth from 2 feet to 20 feet at low tide. Below the mouth of Smith River to the ocean the Umpqua River widens out into an elongated bay or tidal estuary varying in width from three-eighths to 1¼ miles, with a least depth in the channel of 9 feet at low tide. The bay contains a few marshy islands in its upper part, and the area of mud flat exposed at low tide is quite extensive.

The Umpqua River for the last 4 miles just before entering the ocean flows in a southerly direction, and is separated from the ocean by a broad sand spit about 1 mile wide supporting but little vegetation, and covered with dunes of drifting sand, some reaching an elevation of over 200 feet. To the east and south the river is bounded by a rocky shore covered with timber and brush. A marked indentation in this shore forms Winchester Bay just inside the entrance. A group of submerged rocks, visible at extreme low tide, known as Ork reef, lies in the middle of the river opposite Winchester Bay. The main channel is narrow and passes to the northwest side of it. The reef forms no serious obstruction to navigation.

The harbor throat is about 900 feet in width between low-water lines and widens to about one-half mile between shore lines at high water. On the south side of the entrance gorge is a wooded headland, known as Winchester Head, about 300 feet high, terminating in a bluff of rather soft rock at the shore. A rocky reef crops out on the south side of the entrance at Pyramid rock and extends as a submerged reef out in the channel 400 feet from the low-water shore line, but is easily passed by vessels to the north. On the northwest side of the entrance is an extensive low sand flat, bare at low tide, with generally one or two shoal passages through it.

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[a] Not printed.

The sea entrance is obstructed by the usual bar of fine gray sand, the crest of which lies to the southwest of the gorge about one-half mile from the general low tide beach line. At the time of the survey in August the least depth in the bar channel at mean lower low tide was 9 feet. The distance from the 18-foot contour inside to the same contour outside the bar was about 3,100 feet. There is generally but one channel across the bar, which varies in direction from southwest to west. The least bar depth in channel varies from 16 feet to 7 feet at low tide, but is seldom less than 12 or 13 feet.

The tidal area of the Umpqua River is about 9½ square miles, with a mean range of tide of 5 feet. The average rise of the tide above the plane of reference of the map (mean lower low water) is about 6 feet. The average tidal discharge of the river is about 61,000 cubic feet per second. This, of course, is greatly increased at time of spring tides and during freshets. The heavy freshets which occur in the river add an immense volume of fresh water to the tidal discharge and produce changes in the position and depth of bar and sometimes are detrimental by scouring away the sands of the north spit and depositing them on the bar.

For 20 miles south to Coos Bay, and 23 miles north to the mouth of the Siuslaw River, the coast line runs nearly due north and south in a straight line with low sandy shores backed by sand dunes, some of which rise to a height of 200 to 300 feet at the forest line. There are no rocks or hidden dangers off the mouth of the Umpqua and the depth at a distance of 1 mile from shore is about 10 fathoms.

Between the entrance and Gardiner, the principal shipping point, and about 3 miles below that town, there exists a shoal with a controlling depth on it of but 9 feet at mean lower low tide. This shoal is shown on the United States Coast and Geodetic Survey chart No. 638.

## PROPOSED PLAN OF IMPROVEMENT.

The south side of the entrance is held in a permanent position by the rocky shore at Winchester Head, from which place the channel generally takes a southwesterly course to sea.

The maximum depth in the gorge opposite Winchester Head at the time of the survey was 56 feet at mean lower low tide, although the Coast and Geodetic Survey chart of 1885–86 shows it to be 75 feet at the same stage.

The plan of improvement proposed and for which the estimates are made, and which it is thought would result in a permanent depth between Gardiner and the sea of not less than 15 feet at mean lower low water, is to construct two rubblestone high-tide jetties at the entrance to concentrate the ebb current on the bar and to check the cyclic movement of sand at the entrance, especially on the north side. Above the entrance it will be necessary to dredge a channel across the shoal 3 miles below Gardiner to render any increased depth on the bar available for shipping to Gardiner.

It is proposed to locate the receiving wharf for the south jetty just below Winchester Head, at the point A on the accompanying map, from which a jetty tramway approach is to be extended above the high-water mark for 4,300 feet to the point marked B on the map. As possibly the sand would scour away along the channel side of this approach, provision is made in the estimate for a stone-ballasted mat along its channel side. From the point marked B at ordinary high-water line, a high-tide rubble-stone jetty is projected to extend seaward 4,550 feet in a gentle curve with a tangent 1,000 feet long at the end to the point marked C. The total length of the jetty from its initial point at high-water mark is 4,550 feet. This south jetty will hold the ebb current up to the west and prevent its dissipation to the south. It also will prevent the greater part of the drift of the sand into the entrance from the south. This is very considerable in the winter when the prevailing winds are from that quarter.

In addition to the south jetty above described a curved north jetty 5,720 feet long is also projected, to be located on the submerged end of the north spit between the points E and F, 1,700 feet from the south jetty, as shown on the accompanying map. The receiving wharf is to be located at a point, D, near the end of the north spit, connected with the jetty by a short tramway approach between D and E. The chief function of the north jetty would be to arrest the sand movement across the spit, which is much greater on this side than on the south.

It is thought that this arrangement of jetties will give ample depth on the bar to accommodate commerce. An estimate is also made for continuing the north jetty seaward 3,030 feet to point G, leaving 1,500 feet between the jetty ends. This distance, of course, should be varied as may be deemed best at time of construction. It is, however, not believed that this extension will be necessary for many years, and the cost, if this opinion is concurred in, should not form part of the estimated cost of improvement at the present time.

The method of construction is assumed to be the same as that heretofore employed for Oregon coast harbors, viz, depositing from a tramway extended seaward in advance rubblestone in pieces weighing from 25 pounds up to 10 tons or more on a foundation brush mattress, the jetty tramway to be on 4 pile bents 16 feet apart supporting stringers and cross-ties to carry two tracks of 40 pounds to the yard steel rails.

In making the estimate the enrockment is figured at 20 feet wide on top with side slopes of 1 on 1½. Its top is taken at 1 foot above ordinary high tide, and an allowance is made for scour and settlement. In computing the weight of stone one-third of the mass is taken as voids and 150 pounds per cubic foot allowed for weight of the stone. The displacement of the mattresses is neglected, as when compressed under the enrockment, they add but an inconsiderable volume to the jetty.

The materials for jetty construction can be favorably obtained on the Umpqua. The necessary lumber can be secured from the sawmill at Gardiner at a reasonable price. Piles are quoted at 5 cents per linear foot, and the neighboring hills on the south abound with brush. A sandstone of excellent quality crops out in bare bluffs at several places on the navigable tidal portion of the river and can be cheaply quarried.

It will be desirable to plant sand-binding grasses on the north spit, and it is thought that the item for contingencies will cover the expense.

In calculating the necessary dredging across the shoal below Gardiner to secure 15 feet at mean lower low water in a channel 150 feet wide, the United States Coast and Geodetic chart No. 638 was used. The material is mud and sand, and it is estimated that 25 cents per cubic yard, with 20 per cent for engineering and contingencies, will be sufficient to allow for cost of dredging.

The estimates of costs are in detail as follows:

### SOUTH JETTY.

| | |
|---|---|
| Cost of land necessary for site | $1,500.00 |
| Wharf and buildings at A | 7,000.00 |
| Double-track tramway approach from A to B, 4,300 linear feet, at $5 | 21,500.00 |
| Stone-ballasted mattress on channel side from A to B, 4,100 linear feet, at $4.50 | 18,450.00 |
| Jetty double-track tramway from B to C, 4,550 linear feet, at $5 | 22,750.00 |
| Foundation brush mattress from B to C, 23,960 cubic yards, at $1.20 | 28,752.00 |
| Jetty enrockment from B to C, 218,280 tons rubblestone, at $0.90 | 196,452.00 |
| Total | 296,404.00 |
| Engineering superintendence and contingencies, 20 per cent | 59,280.00 |
| Total for south jetty | 355,684.00 |

### SHORT NORTH JETTY.

| | |
|---|---|
| Cost of land necessary for site | 1,000.00 |
| Wharf and buildings at D | 7,000.00 |
| Double-track tramway approach from D to E, 1,000 linear feet, at $5 | 5,000.00 |
| Jetty double-track tramway from E to F, 5,720 linear feet, at $5 | 28,600.00 |
| Foundation brush mattress, E to F, 27,965 cubic yards, at $1.20 | 33,558.00 |
| Jetty enrockment from E to F, 131,319 tons, at $0.90 | 118,187.10 |
| Total | 193,345.10 |
| Engineering superintendence and contingencies, 20 per cent | 38,669.02 |
| Total for north jetty | 232,014.12 |

### DREDGING.

| | |
|---|---|
| Dredging channel 15 feet deep at mean lower low water and 150 feet wide across shoal between Gardiner and mouth of river, 112,444 cubic yards, at $0.25 | 28,111.00 |
| Contingencies, 20 per cent | 5,622.20 |
| Total for dredging | 33,733.20 |

### SUMMARY.

| | |
|---|---|
| South jetty | 355,684.00 |
| North jetty | 232,014.12 |
| Dredging | 33,733.20 |
| Total | 621,431.32 |

### ADDITIONAL ESTIMATE, NORTH JETTY.

Additional estimate, should the demands of commerce in the future require a modification of project by the extension of north jetty from F to G on accompanying map.

| | |
|---|---|
| Jetty double-track tramway from F to G, 3,030 linear feet, at $5 | $15,150.00 |
| Foundation brush mattress from F to G, 9,680 cubic yards, at $1.20 | 11,616.00 |
| Jetty enrockment from F to G, 221,308 tons, at 90 cents | 199,177.20 |
| | 225,943.20 |
| Engineering superintendence and contingencies, 20 per cent | 45,188.60 |
| Total for north jetty extension | 271,131.80 |

SUMMARY OF PROJECT IF JETTY IS EXTENDED FULL LENGTH.

| | |
|---|---|
| Cost of south and north jetties, including dredging | 621,431.32 |
| Extension of north jetty | 271,131.80 |
| Total | 892,563.12 |

As indicated above, it may be stated, therefore, that the estimated cost of improving the entrance to the Umpqua River and the river itself to Gardiner sufficiently for all reasonable demands of commerce, both present and prospective, is $621,431.32, or, in round numbers, $622,000. The unit prices assumed are based on present prevailing rates, which are subject to change.

The estimate is larger than it was thought that it would be at the time of submission of report on preliminary examination of the entrance, under date of March 9, 1903. It seemed probable at that time that perhaps a single jetty of not excessive length would be sufficient for such improvement as the commerce involved would need.

The details of this commerce, so far as it could be obtained, are given in the preliminary report above referred to, and it is therefore not thought necessary to repeat them. While improvement of this entrance is certainly as worthy as at several of the Oregon coast harbors where such work has been undertaken by the General Government, the expenditure of such a large sum as $622,000 can hardly be recommended at the present time. If the estimated cost had proved or could be reduced to something like from one-half to two-thirds of this sum, favorable recommendation would be justified.

Very respectfully, your obedient servant,

W. C. Langfitt,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. Army.*
(Through the Division Engineer.)

[First indorsement.]

U. S. Engineer Office, Northern Pacific Division,
*San Francisco, Cal., November 2, 1903.*

Respectfully forwarded to the Chief of Engineers, U. S. Army.

The river and harbor act of Congress of June 13, 1902, required a preliminary examination of Umpqua River, Oregon, "with a view to ascertaining whether present needs of commerce require improvement at the mouth thereof." The examination was made under direction of Major Langfitt by Assistant Engineer Ogden. Report was submitted under date of March 9, 1903. In this report it was stated: "In view of the favorable showing made in the commerce of the Umpqua, it is thought that if a sufficient improvement could be made for a moderate sum the locality could be reported as worthy. The bar is naturally a good one, good rock, lumber, and piles can be obtained relatively cheaply, and circumstances, generally speaking, are very favorable to low cost of work. An examination of the Coast Survey map of 1885–86 would indicate that probably sufficient improvement could be obtained within reasonable limits of cost. No definite plans or estimates, however, can be submitted without a survey, the cost of which is estimated at $4,000." An allotment for survey was recommended.

The above report was referred for consideration and recommendation by the Board of Engineers provided for by section 3 of said act. This Board reported—"In the opinion of the Board the improvement is one worthy to be undertaken by the United States, provided it can be made at reasonable cost," and recommended an allotment of $4,000 for the necessary survey and estimate to cover the improvement of the river to Gardiner. Major Langfitt's report herewith contains survey, project, and estimate of cost of improvement. There is no doubt that the jetties designed, if built, will produce at least 15 feet depth at low water over the bar.

It is my opinion that both jetties will have to be built to the full length shown on map to produce and maintain the required depth of water. The estimate of cost is somewhat in excess of $892,000.

The whole commerce of the river was reported in the years 1896 and 1902, as follows:

*Commerce for year 1896.*

| | | |
|---|---|---|
| Receipts | tons.. | 1,570 |
| Shipments: | | |
| Lumber | feet.. | 10,000,000 |
| Lath | M.. | 2,000 |
| Salmon | tons.. | 350 |
| Grain | do... | 125 |
| Cattle | do... | 250 |
| Miscellaneous | do... | 58 |

Value of imports, estimated, $103,500.
Value of exports, estimated, $151,450.

*Commerce for year 1902.*

| | | |
|---|---|---|
| Receipts | tons.. | 2,875 |
| Shipments: | | |
| Lumber | feet.. | 16,000,000 |
| Lath | M.. | 2,600 |
| Cattle and hogs | tons.. | 500 |
| Grain | do... | 100 |
| Butter and cheese | do... | 30 |
| Leather | do... | 7 |
| Miscellaneous | do... | 100 |

Value of imports, $150,000.
Value of exports, $225,000.

The report of 1897 shows but two towns, Gardiner and Scottsburg, on the navigable portion of the river, containing an aggregate population of 500, and the industries consisted of one sawmill with a capacity of 80,000 feet B. M. per day, a cannery with an output of 10,000 cases of salmon per year, and a creamery which had shipped 40,000 pounds of butter.

When the comparatively small number of people and commerce to be benefited are considered, it is my opinion that the cost of the improvement is incommensurate with the benefits likely to be derived, and therefore for the present at least I deem the mouth of the Umpqua River as unnecessary and unworthy of improvement.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

## U U 16.

## PRELIMINARY EXAMINATION OF YAQUINA RIVER, OREGON, FROM ITS MOUTH TO ELK CITY.

[Printed in House Doc. No. 240, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, December 1, 1903.*

Sir: I have the honor to submit herewith a report, dated August 19, 1902, by Capt. W. C. Langfitt, Corps of Engineers, on preliminary examination of Yaquina River, Oregon, from its mouth to Elk City, made in pursuance of a requirement in the river and harbor act of June 13, 1902. In the opinion of Captain Langfitt, concurred in by the division engineer, Lieut. Col. W. H. Heuer, Corps of Engineers, the locality is not worthy of improvement by the United States.

This report has been reviewed by the Board of Engineers for Rivers and Harbors, under the provisions of sections 3 and 14 of the above-mentioned act, and in its report of April 1, 1903, the Board expresses the opinion, in which I concur, that it is undesirable for the United States to undertake this improvement.

Very respectfully, your obedient servant,

G. L. Gillespie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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### REPORT OF CAPT. W. C. LANGFITT, CORPS OF ENGINEERS.

United States Engineer Office,
*Portland, Oreg., August 19, 1902.*

General: In compliance with instructions contained in your letter of July 11, 1902, I have the honor to submit the following report on preliminary examination of Yaquina River, Oregon, from its mouth to Elk City.

The terms of the act relating to the examination are as follows: "Yaquina River from its mouth to Elk City."

The Yaquina River is a small stream which takes its rise in the Coast Range of mountains in Lincoln County, Oreg., about 30 miles in a direct line from the Pacific Ocean. Twenty-one miles from its mouth it is joined by its principal tributary, Big Elk, at the small settlement of Elk City. The amount of fresh water carried by both streams is insignificant. The tidal influence extends about 5 miles above Elk City, which is as far as the stream may be considered navigable, and then only for skiffs and light-draft scows.

At Elk City the river is about 160 feet wide; between that point and the mouth of Depot Slough, a distance of 9 miles, it gradually widens to about 800 feet. The controlling depth throughout this part of the river is about 3 feet at mean low tide, although many long stretches have depths of from 5 to 10 feet and even more at the same stage.

There is a silt shoal or bar about 1 mile above the mouth of Depot Slough on which the prevailing depth is 3 feet at mean low tide. Rocky bar, 1½ miles below Elk City, caused by a bowlder slide, is also an obstruction, but can be passed with plenty of water by hugging the north bank. There are also a few snags between Elk City and the mouth of Depot Slough.

There is a mud bar at the mouth of Depot Slough on which the depth is but 2 feet at mean low tide and which interferes with navigation between deep water in the Yaquina River proper and Toledo.

The average range of the tide at Elk City is about 5½ feet, which is but slightly less than at the mouth of the river.

From Toledo downstream to Oysterville, about 6 miles, the river varies in width from 800 to 1,800 feet, except at the first bend below Depot Slough, where it is but 400 feet wide. The channel depths vary from 4 to 20 feet throughout this distance, and two silt bars occur, one at "the Chinamans," about 2 miles below the mouth of Depot Slough, on which the least depth is about 4 feet, and one just above Oysterville, with about 6 feet on it at mean low tide.

About 3 miles below Oysterville the river widens out into Yaquina Bay, which is 3 miles long by about 1 mile wide.

The channel from Oysterville to the bar has a depth of not less than 15 feet at mean low tide, and it can be used by any vessels which can cross the ocean bar at the present time.

From the above description it may be seen that the Yaquina River, for the 21 miles from its mouth to Elk City, is a tidal estuary with an average range of tide of 5½ to 6 feet. The least depth in the channel throughout this distance is about 3 feet at mean low tide, which is the maximum draft which can be carried at that stage.

A narrow strip of bottom land borders the Yaquina River and its tributary sloughs, but it is not extensive or highly cultivated. The neighboring country is hilly and covered with brush, the timber having been destroyed by fire many years ago, and is sparsely populated.

There are only three towns on this stretch of water—Newport, near the entrance, is a small summer resort with about 300 permanent population; Yaquina is the terminus of the Corvallis and Eastern Railroad, 3 miles up the bay, with a slightly less population, and Toledo, the county seat of Lincoln County, has a population of about 600. It is situated on Depot Slough, near its junction with the river.

There is a small salmon cannery near Oysterville, and several tons of fresh salmon and a few oysters are shipped out on the railroad. There are two small sawmills and a creamery at Toledo.

The river is paralleled from Elk City to Yaquina by the Corvallis and Eastern Railroad a line about 140 miles long, running from the interior and crossing the Willamette River at Albany, Oreg.

There is but one steamboat on Yaquina Bay at this time, the *T. M. Richardson*, of 36 gross tons, drawing about 4½ feet, which plies most of the year between the towns of Yaquina and Newport. There are, in addition, three or four small gasoline launches running on the river.

In the valley of the Siletz River, from 10 to 20 miles north of the Yaquina River, there is a very large body of good fir and spruce timber which some day may find an outlet to market by way of Depot

Slough and Yaquina Bay, in which case it would be an advantage to have the shoals between Toledo and Oysterville deepened. To dredge a channel between those points with a least depth at mean low tide of 10 feet, for a width of not less than 100 feet, would necessitate the removal of about 150,000 cubic yards of material, at an approximate cost of $30,000.

The present commerce of the locality needs no assistance, and any increase, either local or from the Siletz Valley, is very problematical.

It is therefore thought that the locality in question is not worthy of improvement by the General Government at this time. A survey is not believed necessary.

Interested parties have been notified and instructed to submit such statements of facts to the Board of Engineers for Rivers and Harbors as they may desire. A sketch map[a] of the locality is transmitted herewith.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., August 23, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army.

On account of the very small commerce existing and in prospect, and the small number of people that would be benefited by the improvement, the locality in question is deemed unworthy of improvement at the present time.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 30, 1902.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, current series, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

A. MACKENZIE,
*Acting Chief of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., April 1, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer and the indorsement of the division engineer thereon.

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[a] Not printed.

The Yaquina River in its present condition furnishes ample facilities for such local commerce as now exists between its mouth and Elk City. Any improvement, if maintained, would involve continuous expenditure, and the immediately prospective commerce appears insufficient to warrant such an undertaking at this time.

The Board therefore believes that it is undesirable that the United States should undertake the improvement of Yaquina River, Oregon, from its mouth to Elk City.

For the Board:

H. F. HODGES,
*Major*, *Corps of Engineers*,
*Senior Member Present.*

# APPENDIX V V.

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## IMPROVEMENT OF WILLAMETTE RIVER, AND OF COLUMBIA RIVER BELOW THE MOUTH OF THE WILLAMETTE, AND THEIR TRIBUTARIES, OREGON AND WASHINGTON.

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### *REPORT OF MAJ. W. C. LANGFITT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1904, WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

#### IMPROVEMENTS.

1. Willamette River above Portland, Yamhill and Long Tom rivers, Oregon.
2. Operating and care of lock and dam in Yamhill River, Oregon.
3. Columbia and lower Willamette rivers below Portland, Oregon.
4. Columbia River below Tongue Point, Oregon.
5. Mouth of Columbia River, Oregon and Washington.
6. Clatskanie River, Oregon.
7. Cowlitz and Lewis rivers, Washington.
8. Gauging waters of Columbia River, Oregon and Washington.

#### EXAMINATIONS.

9. Willamette River, Oregon, between Portland and Oregon City.
10. Willamette River, Oregon, opposite Albany.
11. Yamhill River, Oregon.

#### HARBOR LINES.

12. Columbia River at Astoria, Oregon.

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Engineer Office, United States Army,
*Portland, Oreg., July 15, 1904.*

General: I have the honor to transmit herewith annual report * * * for the fiscal year ending June 30, 1904, for works of river and harbor improvement in my charge.

Very respectfully, your obedient servant,

W. C. Langfitt,
*Major, Corps of Engineers.*

Brig. Gen. A. Mackenzie,
*Chief of Engineers, U. S. A.*

## V V 1.

## IMPROVEMENT OF WILLAMETTE RIVER ABOVE PORTLAND, AND YAMHILL RIVER, INCLUDING THE MAINTENANCE OF LONG TOM RIVER, OREGON.

The details of this work, with status of improvement, are given in the summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

But little work has been done on the upper Willamette River during the year owing to lack of funds, the balance available being withheld for payment for dredge under construction, and its operation.

At the beginning of the fiscal year, work on the construction of a bank revetment near Independence was in progress and the section in hand was completed October 18. This revetment is heavy hand-laid riprap on a 1 on 1½ slope and reenforced in rear across a high-water channel for 500 feet by brush mattress work weighted with stone. The total length of this revetment, as planned, will be about 1,950 feet, but only 1,134 feet have been constructed because of limited funds available for the work. The cost of the section completed was about $10,000, or $8.87 per linear foot. The remaining 800 feet of unprotected bank above this section it is expected to complete whenever funds are available for the purpose.

During the low-water period, from July to October, repairs were made to the dams heretofore constructed at Lamberts, Matheneys, Eldridges, Five Island, Coffee Chute, and Candiani bars. These points are between Portland and Salem, and the regular boats were enabled to continue operations throughout the low-water stage, the least draft being about 24 inches.

This section of river was left clear of the most dangerous snags by means of blasting, but many obstructions encroaching on the navigable channel were of necessity left for such time as the snag boat could be operated.

During extreme low water the gravel bar in the mouth of the Yamhill River was scraped with teams and the channel depth increased from about 2 feet to 3 feet. This was the only work done on the Yamhill River during the year.

No work was done on the Long Tom River, and the benefits to be derived from further expenditures are so small that it is recommended that the Long Tom River be dropped as unworthy of further improvement.

An index map of the upper Willamette and Yamhill rivers, showing the location of the points mentioned, is published in the last annual report, page 2260.

The river and harbor act of June 13, 1902, provided for the construction of a dredge for use on this improvement.

Contracts for a dipper dredge of 1 cubic yard capacity have been let to Joseph Supple, Portland, Oreg., for the hull, and the Featherstone Foundry and Machine Company, of Chicago, Ill., for the machinery, and at the close of the fiscal year it is well along in construction. It is expected to have the dredge completed and in commission for low-water operations about September 1.

On report and recommendation made under date of May 18, 1904, the sum of $12,000 was allotted from the emergency act of April 28, 1904, to be applied to maintenance of existing works, dredging, snagging, etc. The project for expenditure of these funds was approved under date of June 3, 1904, and at the close of the year preparations are in progress for commencement of operations with the snag boat *Mathloma.*

For the work of general improvement, it is estimated that $19,000 will be required for repairs and renewal of plant; $18,000 for operation of the dredge and the snag boat; $6,000 for completion of the revetment at Independence; $10,000 for new revetment at Wheatland; $3,600 for removal of Copeleys Rock near Oswego; $5,000 for repairs to existing works and for auxiliary dams; and $6,200 for engineering, office expenses, and contingencies. The total, $67,800, is a conservative estimate of the amount that can be profitably expended to June 30, 1906.

This work has been in local charge of Mr. David B. Ogden, assistant engineer.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $35,714.03 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | | 12,000.00 |
| | | 47,714.03 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 12,519.21 |
| July 1, 1904, balance unexpended | | 35,194.82 |
| July 1, 1904, outstanding liabilities | | 1,777.50 |
| July 1, 1904, balance available | | 33,417.32 |
| July 1, 1904, amount covered by uncompleted contracts | | 16,262.50 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $13,600.00 | |
| For maintenance of improvement | 54,200.00 | |
| | | 67,800.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |

APPROPRIATIONS.

| Act of— | |
|---|---|
| March 3, 1871 | $16,000 |
| March 3, 1873 | 3,000 |
| June 23, 1874 | 7,500 |
| March 3, 1875 | 25,000 |
| August 14, 1876 | 20,000 |
| June 18, 1878 | 20,000 |
| March 3, 1879 | 12,000 |
| June 14, 1880 | 12,000 |
| March 3, 1881 | 15,000 |
| August 2, 1882 | 5,000 |
| July 5, 1884 | 10,000 |
| August 5, 1886 | 10,000 |
| August 11, 1888 | 29,000 |
| September 19, 1890 | 11,000 |
| July 13, 1892 (of which $3,000 was allotted to Yamhill River) | 30,000 |
| August 18, 1894 (of which $2,000 was allotted to Yamhill River) | $23,000 |
| June 3, 1896 (Willamette and Yamhill rivers) | 40,000 |
| June 4, 1897 (Willamette and Yamhill rivers) | 160,000 |
| Allotted from emergency act June 6, 1900 | 5,000 |
| June 13, 1902 | 68,000 |
| April 28, 1904 (allotted) | 12,000 |
| Total | 533,500 |

NOTE.—By river and harbor act of March 3, 1899, $3,000 was transferred to and expended on improvement of Long Tom River, Oregon.

### CONTRACTS IN FORCE.

Emergency:
- Name of contractor: Joseph Supple,. Portland, Oreg.
- Date of contract: March 16, 1904.
- Character of work: Constructing and delivering boat.
- Amount of work: Hull and house for dredge.
- Price: $6,350.
- Approval: Contract authorized by Chief of Engineers February 20, 1904.
- Date of beginning: 44 days from date of contract.
- Date of expiration: August 1, 1904 (in force June 30, 1904).

Emergency:
- Name of contractor: Featherstone Foundry and Machine Company, Chicago, Ill.
- Date of contract: March 25, 1904.
- Character of work: Furnishing and installing machinery.
- Amount of work: Dredging machinery for one dredge.
- Price: $12,850.
- Approval: Contract authorized by Chief of Engineers February 20, 1904.
- Date of beginning: } Machinery to be installed on dredge not later than August
- Date of expiration: } 1, 1904 (in force June 30, 1904).

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### COMMERCIAL STATISTICS.

The canal and locks at Oregon City, overcoming the falls of the Willamette River, are owned and operated by the Portland General Electric Company, and the following is a statement for the year ending December 31, 1903, of the traffic passing through them:

| | | |
|---|---|---|
| Grain | tons.. | 4,775 |
| Flour and mill stuff | do.... | 3,164 |
| Coal | do.... | 155 |
| Wool | do.... | 280 |
| General merchandise | do.... | 19,936 |
| Potatoes | do.... | 2,475 |
| Hops | do.... | 1,213 |
| Paper stock | do.... | 1,142 |
| Pulp | do.... | 1,460 |
| Paper | do.... | 32,489 |
| Piling | linear feet.. | 562,750 |
| Lumber | feet B. M.. | 1,248,333 |
| Logs | do.... | 12,066,962 |
| Wood | cords.. | 3,266 |
| Passengers | number.. | 16,315 |
| Cattle and horses | do.... | 861 |
| Sheep and hogs | do.... | 98 |

The following statement of traffic on the Willamette River above Portland has been compiled from reports of the various steamers and transportation companies doing business on this part of the river during the year ending December 31, 1903:

| | Tons. |
|---|---|
| Wheat | 6,754 |
| Other cereals | 4,259 |
| Flour | 4,884 |
| Lumber (3,927,107 feet B. M.) | 5,105 |
| Logs (40,275,948 feet B. M.) | 80,551 |
| Shingles (number, 7,094,000) | 355 |
| Pig iron | 3,703 |
| Coal | 862 |
| Hay | 1,936 |
| Wool | 105 |
| Potatoes | 6,012 |
| Fish | 20 |
| Hops | 443 |
| Sand and gravel | 3,117 |
| Stone | 7,923 |
| Wood (26,035 cords) | 39,052 |
| Cattle and horses (number, 648) | 259 |

| | Tons. |
|---|---|
| Sheep and hogs (number, 810) | 60 |
| Fruit | 396 |
| General merchandise | 71,027 |
| Total | 236,823 |

Passengers carried, 66,510.

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## REVISED PROJECT FOR IMPROVEMENT.

United States Engineer Office,
*Portland, Oreg., October 15, 1903.*

General: In compliance with instructions contained in two letters, dated Office Chief of Engineers, July 22, 1903, I have the honor to submit herewith a revised project, with estimate of cost, for the improvement of the upper Willamette and Yamhill rivers, Oregon.

In connection with the revision of this project attention is respectfully invited to the existing project as outlined in the Annual Reports of the Chief of Engineers for 1896, page 3309; 1897, page 507, and also to the general description of the river and operations thereon for the past thirty years in the Annual Report for 1901, page 3553.

As stated in the 1901 report, experience has proven it impracticable to fulfill the requirements of the present project, which provides for a low-water depth of from 2 to 2½ feet on the upper 50 miles of the Willamette River between Corvallis and Eugene. Some four years ago an attempt was made by a navigation company at Eugene to operate a regular boat between Portland and that city during the high and medium stages of the river. However, as navigation on the upper stretch proved difficult and impracticable, the venture was abandoned after a few months' trial, and there has been no steam navigation above Harrisburg since that time.

On the 30-mile stretch between Harrisburg and Corvallis there is more or less navigation during the winter months for the reason that the country adjacent to the river in the vicinity of Peoria and Finleys Landing offers considerable grain for shipment to Portland by boat. This is, however, during the high-water season, and the only obstructions to free navigation are snags, drift, and leaning trees. The relative location of the points named are shown on the accompanying sketch[a] of the river.

It is recommended that the 20-mile stretch between Harrisburg and Eugene be abandoned as not susceptible of improvement at reasonable cost, and that future operations on the thirty-odd miles of river between Harrisburg and Corvallis be confined mainly to snagging, with a view to providing unobstructed high-water navigation. Unstable timber banks, undermined by a continual shifting channel, makes snagging a necessity each year. Experience has also shown that this work thoroughly done on the upper section of the river during high and medium water stages reduces the amount of this work on the lower section of the river by preventing any snags working downstream where, if not promptly removed, they are apt to lodge and form shoals.

Considering the unstable and shifting character of the bed of the river, the results of past efforts and its present condition, I am of the opinion that it is impracticable to outline a plan for permanent improvement which can be completed at a given cost. It is, however, believed that the 119 miles of river between Corvallis and Portland is susceptible of improvement under a continuous system of snagging and dredging with auxiliary dam and revetment construction, and that ultimately a low-water depth of from 2½ to 3½ feet can thus be obtained between Corvallis and Portland.

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[a] Not printed.

It is therefore recommended that the work of general improvement, with the exception of snagging during the high water season, be confined to the river below Corvallis, and that provision be made, if possible, by which the work of snagging and dredging may be continued annually.

On this 119 miles of river there are some twenty or more distinct shoals, varying in depth from 1½ to 2½ feet, and are for the most part composed of loose, shifting sand and gravel. It is proposed to gain the desired low-water depths over these shoals by dredging a narrow channel, generally along the line of greatest current, and in some cases to augment and maintain this channel by construction of wing and closing dams.

There are also points along the Willamette River where the high-water current threatens the formation of new channels by reason of adjacent low ground and badly caving banks, to the injury of the immediate locality as well as to navigation. The protection of such points, while in some cases of local as well as of general benefit to the river, should be included in the project for general improvement. At Corvallis and Independence revetments have been constructed and require maintenance and extension, and at Albany a revetment is contemplated, as outlined in the report from this office to the Chief of Engineers, dated April 13, 1903. Serious encroachments in the banks have been made in recent years opposite Salem and just below Wheatland, and it is evident that extensive revetments must in time be constructed, particularly below Wheatland, to prevent the formation of new channels.

On the lower stretch of river at Rock Island, 17 miles above Portland, and near Oswego, 8 miles above Portland, there are reefs and rocks, more or less a menace to navigation, which should be removed by blasting. The removal of the Oswego reef (Copeleys Rock) is included in an estimate submitted in a report from this office to the Chief of Engineers on a survey of the Willamette River between Portland and Oregon City, dated May 1, 1903.

The existing project provides for a low-water depth of 12 feet over the first 8 miles of river between Portland and Oswego, and to obtain this depth shoals at Ross Island and Sellwood must be dredged, as outlined in the above-mentioned report dated May 1, 1903. It is recommended that this provision be retained in the revised project, and that the down-stream limit of the 12-foot channel be at the head of deep water navigation in the harbor of Portland, approximately 1 mile above Madison Street Bridge, and that the deepening of these shoals be made a part of the general dredging operations on the upper Willamette to be done at such time as the demands of commerce shall necessitate.

On the Yamhill River no work is at present required except general snagging and some little dredging each year.

The last river and harbor act provided for the construction of a 1½ cubic yard dipper dredge for use on the Willamette and Yamhill rivers. Satisfactory plans for this dredge have been secured, and the contract for its construction is now pending. It is expected that the dredge will be built during the coming winter and be ready for use at the beginning of the low-water season of 1904.

The hull of the snag boat *Mathloma*, built in 1896, is now in need of renewal. The boat is in commission, rendering efficient service, but it is believed that it can not be operated with safety in its present condition longer than one year more at the most, and it is recommended that a new hull and house be constructed as soon as practicable. In equipping the new boat, new steam capstans should be provided to replace those now in use, which were originally purchased in 1886 for one of the early snag boats, and which are now of old pattern, worn out, and unsuitable for the work required. All other snagging equipment, hoisting engines, and main propelling machinery are in good condition and can be transferred to the new boat. The boiler, which has been in use for a number of years on several boats, is apparently in good condition, but it is possible that it may not be able to fully meet the requirements now demanded by marine regulations, and in case it should not a new boiler will also be a necessity.

The pile driver, which has been in use on the upper river for the past six years, is also in need of extensive repair, and will require a new scow and hammer gins during the coming year.

A detailed estimate of the cost of the work proposed under this revised project is as follows:

| | |
|---|---|
| 1. Repairs to plant, including snag boat and pile driver | $19,000 |
| 2. Corvallis revetment, maintenance and extension | 10,000 |
| 3. Albany revetment, new | 27,000 |
| 4. Independence revetment, maintenance and extension | 10,000 |
| 5. Salem revetment, new | 25,000 |
| 6. Wheatland revetment, new | 15,000 |
| 7. Rock Island reefs, removal | 2,000 |
| 8. Copeleys Rock, removal | 3,600 |
| 9. Dredging, Portland to Oswego (not at present necessary) | 16,500 |
| 10. Auxiliary dams, and maintenance of existing works, two years' time | 30,000 |
| 11. Snag boat and crew, sixteen months' time | 24,000 |
| 12. Dredge boat and crew, twelve months' time | 12,000 |
| Total | 194,100 |
| Engineering, office expenses, and contingencies, 10 per cent | 19,400 |
| Total cost | 213,500 |

Item 9 can be omitted for the present. Item 1 is needed as soon as it can possibly be obtained. Items 10, 11, and 12 provide for auxiliary dam construction, maintenance of existing works, and the operation of the two boats for a period of two years. If annual appropriation can be secured, $33,000 will be sufficient. In connection with the general dam construction and repairs, there may be points other than those named above where revetments will be needed in the future.

The estimate may then be stated as follows:

| | |
|---|---|
| For immediate expenditure on permanent works, items 2 to 8 | $92,600 |
| For repairs to plant | 19,000 |
| Engineering, office expenses, and contingencies | 11,400 |
| Total | 123,000 |
| For maintenance and extension of existing works annually, item 10 | 15,000 |
| For operation of dredge and snag boat annually, items 11 and 12 | 18,000 |
| Engineering, office expenses, and contingencies | 3,300 |
| Total for maintenance and operation per year | 36,300 |

The first appropriation, therefore, should be $195,600, and $72,600 every two years thereafter.

Respectfully submitted.

W. C. Langfitt,
*Major, Corps of Engineers, U. S. A.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. Engineer Office, Northern Pacific Division,
*San Francisco, Cal., November 2, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

For reasons stated, I believe it is impracticable to maintain 2 to 2½ feet low water channel depths between Corvallis and Eugene. If snags lodge or form in this portion of the river I should recommend their occasional removal by the Government snag boat, if that be practicable, at reasonable expense, rather than abandon that long stretch of river.

The other parts of the project and estimate are recommended for approval.

W. H. Heuer,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

## V V 2.

## OPERATING AND CARE OF LOCK AND DAM IN YAMHILL RIVER, OREGON.

### OPERATIONS DURING THE FISCAL YEAR 1904.

The lock was closed to navigation because of high water on November 6, 1903, and during the following winter months, until April 8, was closed to traffic ninety-three days and open sixty-one days. Since April 8 the lock has been continuously available for navigation. The highest water of the year occurred February 18, and registered 11½ feet above the top of the lock walls. This high water caused no damage to the lock or dam nor to the adjacent banks and slopes.

During the year the lock, dam, adjacent grounds, and general property have been kept in repair. The gates, operating gear, and lock buildings were painted and gravel walk ways laid in the grounds in lieu of wood to overcome flotation at high water.

*Detail summary of expenditures for operating and care of lock and dam in Yamhill River, Oregon, during fiscal year ending June 30, 1904.*

| Month. | Operating and care. |  | Engineering, office expenses, and contingencies. | Total. |
|---|---|---|---|---|
|  | Labor. | Materials. |  |  |
| 1903. |  |  |  |  |
| July | $66.50 |  |  | $66.50 |
| August | 82.75 | $8.25 |  | 91.00 |
| September | 171.50 |  |  | 171.50 |
| October | 106.69 |  | $175.00 | 281.69 |
| November | 88.50 | 14.02 |  | 102.52 |
| December | 68.00 |  |  | 68.00 |
| 1904. |  |  |  |  |
| January | 62.00 |  |  | 62.00 |
| February | 61.00 |  |  | 61.00 |
| March | 60.00 |  | 10.50 | 70.50 |
| April | 65.00 |  |  | 65.00 |
| May | 60.00 |  |  | 60.00 |
| June | 74.00 |  | 87.50 | 161.50 |
| Total | 960.94 | 22.27 | 273.00 | 1,256.21 |

*Summary of expenditures made in operating and caring for lock and dam in Yamhill River, Oregon, during the fiscal year ending June 30, 1904, submitted in compliance with river and harbor act of July 5, 1884.*

| Items of estimate. | Amount expended. |
|---|---|
| Operating and general care of lock | $983.21 |
| Engineering, contingencies, and office expenses | 273.00 |
| Total | 1,256.21 |

COMMERCIAL STATISTICS.

*Statement showing traffic through lock and dam in Yamhill River, Oregon, during fiscal year ending June 30, 1904.*

| Date. | Lock open. | Lock closed. | Number of lockages. | Time operating. |  | Freight carried— |  | Passengers carried. |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | Logs over dam. | Through lock. |  |
| 1903. | *Days.* | *Days.* |  | h. | m. | *Tons.* | *Tons.* |  |
| July | 31 |  | 8 | 7 | 11 |  | 151 | 3 |
| August | 31 |  |  |  |  |  |  |  |
| September | 30 |  | 2 | 0 | 35 |  | 48 |  |
| October | 31 |  | 2 | 0 | 30 |  |  | 3 |
| November | 14 | 16 | 1 | 0 | 12 | 750 |  | 2 |
| December | 25 | 6 | 1 | 0 | 30 |  | 60 |  |
| 1904. |  |  |  |  |  |  |  |  |
| January | 15 | 16 | 1 | 0 | 40 |  | 34½ |  |
| February | 10 | 19 |  |  |  | 67 |  |  |
| March | 31 |  |  |  |  |  |  |  |
| April | 25 | 5 | 2 | 2 | 45 | 900 | 81 |  |
| May | 31 |  | 4 | 3 | 40 |  | 97½ | 4 |
| June | 30 |  | 13 | 4 | 37 |  | 168 | 14 |
| Total | 273 | 93 | 34 | 20 | 40 | 1,717 | 640 | 26 |

All freight carried was logs, with the exception of 1 ton of crawfish and 48 tons of gravel.

There have been no steamer lockages during the year, both lines of boats which formerly ran to McMinnville having abandoned the run above Dayton (2 miles below lock) because it is claimed that uncertainty of lock operations during the high-water season makes it impossible to compete with railroad rates. For report on examination of this lock and dam with a view of correcting this feature, see House Document No. 78, Fifty-eighth Congress, second session, and Appendix V V 11 herewith.

The relative location of the Yamhill River, the lock, dam, and adjacent points are shown on a map accompanying last year's report for improving Williamette and Yamhill rivers, published in the Annual Report of the Chief of Engineers for 1903, page 2260.

*Money statement.*

| | |
|---|---|
| Amount allotted July 14, 1903, from indefinite appropriation | $2,300.00 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 1,256.21 |
| July 1, 1904, balance unexpended | 1,043.79 |

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ALLOTMENTS.

| | |
|---|---|
| September 19, 1900 | $1,460 |
| January 18, 1901 | 1,500 |
| May 24, 1901 | 23,200 |
| July 12, 1902 | 2,700 |
| July 14, 1903 | 2,300 |
| Total | 31,160 |

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## V V 3.

## IMPROVEMENT OF COLUMBIA AND LOWER WILLAMETTE RIVERS BELOW PORTLAND, OREGON.

For further information relative to the improvement of these streams, attention is invited to the summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

During the year the works of improvement consisted in deepening the channel by dredging; removing the old revetment at the head of Coon Island; dredging an opening in Swan Island dike; snagging; blasting out a submerged rock in the Columbia River opposite La Du, and miscellaneous work connected with surveys, etc.

Besides the work done by the United States, the port of Portland did extensive work with its dredges, and also constructed a floating dry dock which is located at St. Johns, Oreg.

Extensive improvements were also carried on at the new Government moorings.

The U. S. dredge *W. S. Ladd* worked during the fiscal year in deepening the channel across a number of bars in the Lower Columbia. The localities at which she worked, with results and cost, are shown in Tables Nos. 1 and 2 of this report.

The port of Portland dredge *Columbia* continued to work under contract dated October 17, 1902, from the beginning of the fiscal year until January 6, 1904, also from June 23, 1904, to June 25, 1904. Table No. 3 shows amount of work done, with results.

The U. S. dipper dredge *No. 1* worked at Swan Island dike from November 15 to December 15, 1903, and took out the dike for a width of 200 feet to a depth of 6 feet below low water. The total amount of material dredged, consisting of brush, stone, and sand, was 2,937 cubic yards, at a cost for labor, material, subsistence, and fuel of $790.14, or 26.9 cents per cubic yard.

On December 15 she was towed to Coon Island revetment and commenced dredging out the stone and brush of which it was composed, this work having been authorized. She worked until high water in the Columbia caused a suspension of operations on April 16. During that period a total of 2,374.5 cubic yards of stone, brush, and sand were removed and deposited so as to form a dike at the lower end of the part removed extending out from the shore of the island. The total cost for labor, fuel, subsistence, and material was $3,413.29, or $1.43 per cubic yard. The length of revetment dredged out was 492 linear feet, at a cost per linear foot of $6.93. A great deal of time was lost before a satisfactory dipper was secured, also through storm and strong current.

The port of Portland commission has also operated its 20-inch Bowers dredge, as well as the dredge *Columbia*, when she was not employed by the United States, at different points, and reports excavations as follows:

| | Cubic yards. |
|---|---|
| Portland Harbor | 308,035 |
| Dry Dock Berth | 264,911 |
| Swan Island | 139,009 |
| Mouth of Willamette | 95,431 |
| Reeders and Willow bars | 122,694 |
| Upper Martins | 15,266 |
| Lower Martins | 29,154 |
| Hunters | 80,155 |
| Slaughters | 112,795 |
| Total | 1,167,450 |

TABLE No. 1.

*Table showing work done by dredge Wm. S. Ladd during fiscal year ending June 30, 1904.*

| Locality. | Periods at work. | Days working. | Hours pumping. | Material moved. | Minimum depth. | | Width of dredged cut. | Days repairing machinery. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Before. | After. | | |
| | | | | Cu. yds. | Feet. | Feet. | Feet. | |
| Pillar Rock, Upper and Lower bars. | Feb. 9 to Apr. 30, 1903 | 64 | 308 | 187,203 | 19¼ | 22 | 300 | 2 |
| Harringtons Point bar | July 1 to Aug. 17, 1903 | 18 | 100 | 46,691 | 20¼ | 22 | 300 | 21 |
| Bar at Beacon No. 2 | Aug. 18 to Oct. 31, 1903 | 55 | 267 | 134,067 | 18¼ | 21¼ | 300 | 3 |
| Cut below Taylor Sands | Nov. 1, 1903, to Feb. 8, 1904 | 107 | 570 | 104,078 | 18¼ | 23 | 300 | 9 |
| Upper Sands | Apr. 30 to June 30, 1904 | | | 193,998 | 17½ | 20¼ | 300 | |
| Total | | 244 | 1,245 | 666,087 | | | | 35 |

date of June 4, 1904, and the work will be commenced as soon as present high water has subsided.

The present contract for hire of this dredge ceases with the close of the present fiscal year. A new contract has been entered into under same conditions, viz: $235 per day for the 30-inch dredge and $155 per day for the 20-inch dredge.

A project has been adopted and the work is now in progress with a view of obtaining a depth of 40 feet on the bar at the mouth of the Columbia River, and it would now seem that Congress should consider the improvement of the channel from Portland to the mouth of the river with a view to its improvement and betterment. The commerce of the river will naturally increase if the bar and river channels contemplated are secured and maintained, and the amount of commerce affected will certainly warrant the work necessary to secure a 25-foot channel over this stretch of river. The river is not now available for vessels of the larger draft to Portland, and on this account it is claimed that considerable transport and other business have been lost to this community.

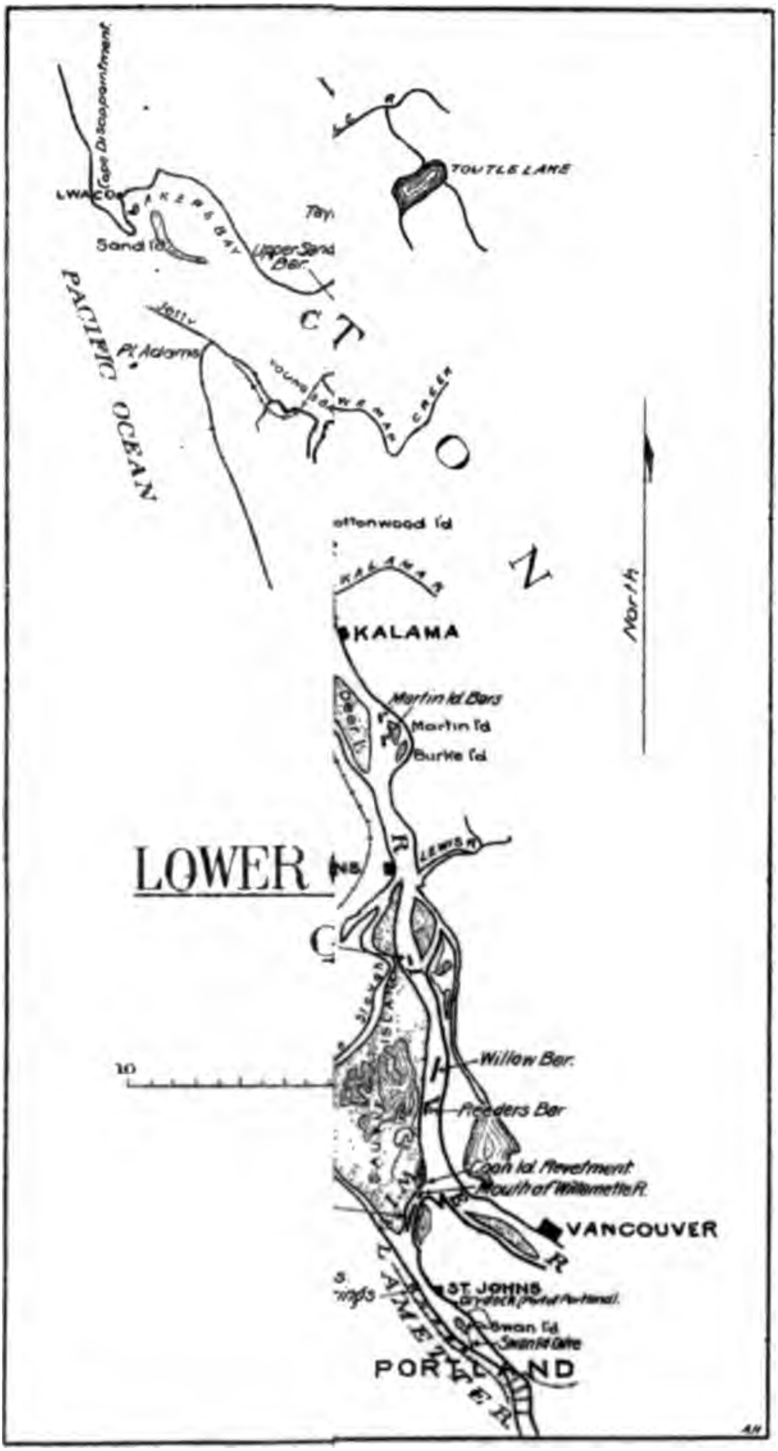
The sum of $500,000 is therefore named in the money statement for expenditure on works of permanent improvement in the fiscal year 1906, in addition to the balance available. The amount required for maintenance is $125,000, which is needed principally for dredging, and is essential for maintaining the present conditions.

The appropriation of these sums—a total of $625,000—will enable the existing channels to be maintained and a beginning made on some of the permanent works of improvement included in the project. The funds for maintenance are essential in any event, and will have to be expended from any funds made available for the work. The full sum of $625,000 should therefore be appropriated without reduction, which, with the balance on hand, is to be applied to work under the approved project.

This work is in charge of Mr. Gerald Bagnall, assistant engineer.

*Money statement.*

| | | |
|---|---|---|
| July 1, 1903, balance unexpended | | $176,847.30 |
| Amount allotted from appropriation for maintenance of river and harbor improvement, act of April 28, 1904 | | 15,000.00 |
| Deposited account proceeds Government property | | 51.00 |
| Deposited account Treasury settlement | | 34.35 |
| | | 191,932.65 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | | 96,375.11 |
| July 1, 1904, balance unexpended | | 95,557.54 |
| July 1, 1904, outstanding liabilities | | 5,243.50 |
| July 1, 1904, balance available | | 90,314.04 |
| July 1, 1904, amount covered by uncompleted contracts | | 2,280.00 |
| Amount (estimated) required for completion of existing project | | 2,673,509.93 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $500,000.00 | |
| For maintenance of improvement | 125,000.00 | |
| | | 625,000.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | | |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## APPROPRIATIONS.

| | | |
|---|---|---|
| ower Willamette, act of— | | |
| June 23, 1866 | [illegible] | |
| March 2, 1867 | [illegible] | |
| July 25, 1868 (allotted) | [illegible] | |
| April 10, 1869 (allotted) | [illegible] | |
| July 11, 1870 | [illegible] | |
| June 10, 1872 | [illegible] | |
| | | [illegible] |
| ower Willamette, from Portland to the sea, act of— | | |
| March 3, 1873 | [illegible] | |
| June 23, 1874 | [illegible] | |
| March 3, 1875 | [illegible] | |
| August 14, 1876 | [illegible] | |
| June 18, 1878 | [illegible] | |
| March 3, 1879 | [illegible] | |
| | | [illegible] |
| ower Willamette and Columbia, from Portland to the sea, including bar at the mouth of Columbia, act of— | | |
| June 14, 1880 | [illegible] | |
| March 3, 1881 | [illegible] | |
| August 2, 1882 | [illegible] | |
| | | [illegible] |
| olumbia and Lower Willamette, below Portland, Oreg., act of— | | |
| July 5, 1884 | [illegible] | |
| August 5, 1886 | [illegible] | |
| August 11, 1888 | [illegible] | |
| September 19, 1890 | [illegible] | |
| July 13, 1892 | [illegible] | |
| August 18, 1894 | [illegible] | |
| June 3, 1896 | [illegible] | |
| March 3, 1899 | [illegible] | |
| | | [illegible] |
| une, 1899, deposited to credit of appropriation | | [illegible] |
| lay, 1901, deposited to credit of appropriation | | [illegible] |
| ct of June 13, 1902 | | [illegible] |
| ecember 3, 1902, deposited to credit of appropriation, account [illegible] | | [illegible] |
| ct of April 28, 1904 (allotted) | | [illegible] |
| ugust 17, 1903, deposited to credit of appropriation, account [illegible] | | [illegible] |
| 'reasury settlement, Major Post, October, 1887, [illegible]; [illegible] ruary, 1887, Colonel Jones, account overpayment, $[illegible] | | [illegible] |
| Total | | [illegible] |

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## CONTRACTS IN FORCE.

'ormal:
- Name of contractor: Port of Portland Commission, Portland, Oreg.
- Date of contract: October 17, 1902.
- Nature of contract: Hire of dredges.
- Character of work: Dredging.
- Amount of work: Indefinite.
- Prices: $155 per day for use of [illegible] dredge; $225 per day for use of [illegible] dredge.
- Date of approval: December 12, 1902.
- Date of beginning: Upon two weeks' notification any time after date of contract.
- Date of expiration: June 30, 1904.

Emergency:
- Name of contractor: Geo. W. Sanborn, Astoria, Oreg.
- Date of contract: December 4, 1902.
- Character of work: Furnishing and delivering coal.
- Amount of work: Indefinite. Approximate delivery, 2,000 tons.
- Prices, per ton of 2,240 pounds: $5.[illegible] delivered at Astoria, Oreg.; $[illegible] delivered at Kalama, Wash.; $5.[illegible] delivered at Portland, Oreg.
- Approval: Not required.

Emergency—Continued.
Date of beginning: January 1, 1903.
Date of expiration: December 31, 1903.

Emergency:
Name of contractor: Geo. W. Sanborn, Astoria, Oreg.
Date of contract: January 4, 1904.
Character of work: Furnishing and delivering coal.
Amount of work: Indefinite. (Approximate delivery, 12,000 tons.)
Prices, per ton of 2,240 pounds: $5.45 for "Roslyn" mine-run delivered at Astoria, Oreg.; $5.45 for "Roslyn" mine-run delivered at Kalama, Wash.; $5.30 for "Roslyn" mine-run delivered at Fort Stevens, Oreg.; $5.65 for "Roslyn" lump delivered at Astoria, Oreg.; $5.65 for "Roslyn" lump delivered at Kalama, Wash.; $5.50 for "Roslyn" lump delivered at Fort Stevens, Oreg.; $5.75 for "Franklin" mine-run delivered at Astoria, Oreg.; $5.75 for "South Prairie" mine-run delivered at Astoria, Oreg.; $5.75 for "South Prairie" mine run delivered at Kalama, Wash.; $5.75 for "South Prairie" mine-run delivered at Fort Stevens, Oreg.
Approval: Contract authorized by Chief of Engineers, December 18, 1903.
Date of beginning: Whenever required after date of contract.
Date of expiration: December 31, 1904. (In force June 30, 1904.)

Emergency:
Name of contractor: Joseph Supple, Portland, Oreg.
Date of contract: January 12, 1904.
Character of work: Repairs to barge.
Amount of work: Indefinite.
Price: $735 for the whole work.
Approval: Not required.
Date of beginning: 5 days after date of contract.
Date of expiration: 40 days from date of beginning.

Emergency:
Name of contractor: Astoria Iron Works, Astoria, Oreg.
Date of contract: January 18, 1904.
Character of work: Replacing steam boiler on tugboat.
Amount of work: One boiler.
Price: $4,560 for the whole work.
Approval: Not required.
Date of beginning: } To be completed within 120 days from date of contract.
Date of expiration: }
Extension: Date of expiration extended for a reasonable time. (In force June 30, 1904.)

Emergency:
Name of contractor: Willamette Iron and Steel Works, Portland, Oreg.
Date of contract: January 20, 1903.
Character of work: Casting and machine work.
Amount of work: Two complete pumps.
Price: $950 for the whole work.
Approval: Not required.
Date of beginning: On date of contract.
Date of expiration: 60 days from date of beginning.

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## COMMERCIAL STATISTICS.

*Arrivals and clearances of vessels at Astoria, Oreg., during the year ending December 31, 1903.*

[From collector of customs at Astoria, Oreg.]

| Vessels. | Coastwise. | | Foreign ports. | | Total. | |
|---|---|---|---|---|---|---|
| | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. |
| Arrrived | 845 | 1,006,456 | 66 | 175,558 | 911 | 1,182,014 |
| Cleared | 794 | 908,210 | 12 | 16,720 | 806 | 924,930 |
| Total | 1,639 | 1,914,666 | 78 | 192,278 | 1,717 | 2,106,944 |

*Commerce for the year ending December 31, 1903.*

| | |
|---|---|
| Value of exports | $43,843.00 |
| Value of imports | 20,643.20 |
| Duties collected | 3,857.74 |

Principal items of export are lumber, wheat, barley, fruits, and salmon.

Principal items of import are coal, cement, pig iron, Japanese merchandise, Chinese merchandise, tea, rice, and silk.

*Arrivals and clearances of vessels at Portland, Oreg., during the year ending December 31, 1903.*

[From collector of customs at Portland, Oreg.]

| Vessels. | Coastwise. | | Foreign ports. | | Total. | |
|---|---|---|---|---|---|---|
| | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. |
| Arrived | 317 | 328,951 | 33 | 78,443 | 350 | 407,394 |
| Cleared | 244 | 194,050 | 103 | 218,137 | 347 | 412,187 |
| Total | 561 | 523,001 | 136 | 296,580 | 697 | 819,581 |

*Commerce for the year ending December 31, 1903.*

| | |
|---|---|
| Value of exports to foreign countries | $9,965,864.00 |
| Value of imports from foreign countries | 2,708,748.00 |
| Duties collected | 764,213.90 |

*Registered tonnage over Columbia River bar, calendar year 1903.*

| | Deep-sea sailing vessels. | | | | | | Coasters. | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | American. | | British. | | Other flags. | | | | | |
| | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. |
| Inward to Astoria and Portland | 9 | 6,137 | 35 | 115,055 | 22 | 54,366 | 486 | 485,191 | 552 | 610,749 |
| Outward from Portland and Astoria | 19 | 12,447 | 64 | 186,828 | 43 | 102,216 | 519 | 604,755 | 645 | 906,246 |
| Total | 28 | 18,584 | 99 | 301,883 | 65 | 156,582 | 1,005 | 1,089,946 | 1,197 | 1,516,995 |

Total freight, foreign and coastwise, carried in and out over the Columbia River bar during the calendar year 1903, 832,184 tons.

*Statement showing principal articles and tonnage of foreign exports and imports at Portland, Oreg., during the calendar year 1903.*

| Articles. | Tons. | Articles. | Tons. |
|---|---|---|---|
| EXPORTED. | | IMPORTED. | |
| Wheat | 168,443 | Coal | 15,844 |
| Flour | 101,686 | Manila | 1,934 |
| Barley | 31,768 | Sulphur | 4,042 |
| Timber | 76,445 | Bags | 943 |
| Canned salmon | 39 | Rice | 8,298 |
| Cotton | 288 | Sugar | 36 |
| Liquor | 191 | Tea | 368 |
| Salt beef | 7 | Coffee | 120 |
| Oats | 860 | Salt | 1,806 |
| Tobacco, leaf | 54 | Cement | 35,373 |
| | | Window glass | 891 |
| | | Pig and bar iron | 21,913 |
| | | Spirits | 68 |
| | | Matting | 581 |
| | | Clay | 943 |
| Total | 379,781 | Total | 87,549 |

The following statement of traffic on the Columbia and lower Willamette rivers has been compiled from reports of the various steamers and transportation companies doing business on these rivers during the calendar year 1903.

| Articles. | Tons. | Articles. | Tons. |
|---|---|---|---|
| Wheat | 20,720 | Railroad iron | 1,630 |
| Other cereals | 17,960 | Shingles | 5,210 |
| Flour and feed | 32,224 | Piles (3,044,718 linear feet) | 60,894 |
| Potatoes | 23,291 | Lumber (61,654,312 feet B. M.) | 80,150 |
| Fruit | 7,465 | Logs (446,330,000 feet B. M.) | 892,260 |
| Fish | 21,474 | Sand and gravel | 170,725 |
| Hops | 1,023 | Stone | 8,059 |
| Hay | 11,306 | Brick | 1,280 |
| Wool | 983 | | |
| General merchandise | 187,874 | Handled by river vessels | 1,596,220 |
| Wood (28,631 cords) | 42,946 | Handled by seagoing vessels | 832,184 |
| Coal | 3,087 | | |
| Cattle and horses (number, 10,375) | 4,150 | Total | 2,428,404 |
| Sheep and hogs (number, 21,453) | 1,509 | | |

Passengers carried by river vessels, 264,561.

*List of steam vessels plying the Willamette and lower Columbia rivers and their tributaries between Portland and Astoria, Oreg.; the upper Willamette and Yamhill rivers and their tributaries above Portland, Oreg., during the calendar year 1903, furnished by the inspectors of boilers and hulls at Portland, Oreg.*

[This list does not include seagoing vessels.]

| Name of vessel. | Net tonnage. | Depth. | | Name of vessel. | Net tonnage. | Depth. | |
|---|---|---|---|---|---|---|---|
| | | Ft. | in. | | | Ft. | in. |
| Alarm | 21 | 5 | 8 | Lillian B. | ........ | ........ | |
| Albany | 401 | 4 | 5 | Lizzie | 31 | 6 | 4 |
| Altona | 242 | 4 | 8 | Lottie | ........ | ........ | |
| America | 67 | 6 | 2 | Lurline | 338 | 6 | 6 |
| Annie Comings | 431 | 5 | 6 | Mathloma | 270 | 4 | 0 |
| Argonaut | 20 | 7 | 7 | Maria | 184 | 5 | 9 |
| Astorian | 234 | 7 | 5 | Mayflower | 56 | 6 | 0 |
| Bailey Gatzert | 444 | 8 | 0 | M. F. Henderson | 315 | 7 | 5 |
| Callender | 57 | 6 | 2 | Mascot | 199 | 5 | 0 |
| Canby | 49 | 5 | 4 | Melville | 64 | 6 | 9 |
| Cascades | 267 | 5 | 6 | Metlako | 122 | 4 | 8 |
| Cash | 34 | 4 | 6 | Modoc | 354 | 4 | 8 |
| Charles R. Spencer | 284 | 6 | 0 | N. R. Lang | 381 | 6 | 2 |
| Chester | 98 | 3 | 8 | Nahcotta | 112 | 6 | 5 |
| City of Eugene | 214 | 4 | 5 | Naiad | 8 | 4 | 0 |
| Clara | 5 | 2 | 5 | Nellie | 59 | 4 | 2 |
| Colwell | 11 | 3 | 5 | Nestor | 78 | 5 | 0 |
| Cygnet | ........ | ........ | | Norma | 452 | 5 | 6 |
| Dalles City | 323 | 8 | 2 | Northwest | 301 | 4 | 8 |
| Dovie | 7 | 3 | 5 | No Wonder | 235 | 5 | 6 |
| Eclipse | 40 | 5 | 6 | Ocklahama | 565 | 8 | 3 |
| Edith | 37 | 9 | 8 | O. K | 47 | 5 | 2 |
| Electro | 55 | 5 | 6 | Paloma | 112 | 5 | 4 |
| El Hurd | 26 | 6 | 2 | Petrel | 8 | 4 | 5 |
| Elkkader | 21 | 4 | 0 | Pomona | 295 | 6 | 1 |
| Elmore | 467 | 4 | 5 | Regulator | 308 | 7 | 7 |
| Enterprise | 209 | 4 | 5 | Reliance | 104 | 6 | 5 |
| Eugene | 250 | 6 | 6 | Republic | 60 | 5 | 0 |
| F. B. Jones | 193 | 7 | 0 | R. Miler | 56 | 6 | 8 |
| Fannie | 276 | 6 | 6 | R. R. Thompson | 912 | 9 | 6 |
| Florence | ........ | ........ | | Resolute | 12 | 5 | 0 |
| Flyer | 258 | 15 | 0 | Robt. T. Lincoln | 50 | 7 | 0 |
| G. H. Mendell | 90 | 7 | 0 | Ruth | 388 | 4 | 6 |
| Glenola | 276 | 5 | 4 | Samson | 189 | 15 | 6 |
| G. M. Walker | 125 | 4 | 2 | Sarah Dixon | 278 | 6 | 5 |
| Game Cock | 658 | 7 | 9 | Stranger | 51 | 6 | 0 |
| Grey Eagle | 162 | 4 | 7 | Tacoma | 1,311 | 11 | 7 |
| Harvest Queen | 430 | 9 | 0 | Tahoma | 154 | 6 | 0 |
| Hassalo | 428 | 8 | 4 | Tatoosh | 154 | 15 | 5 |
| Hercules | 293 | 8 | 6 | T. J. Potter | 533 | 11 | 4 |
| Hoo-Hoo | 16 | 3 | 2 | Undine | 280 | 6 | 6 |
| Hustler | 129 | 7 | 0 | Vancouver | 157 | 7 | 0 |
| Ione | 213 | 5 | 0 | Vanguard | 51 | 4 | 8 |
| Iralda | 59 | 3 | 7 | Victor | 27 | 5 | 7 |
| James B. Stephens | 16 | 3 | 0 | Volga | 48 | 4 | 0 |
| Jessie Harkins | 55 | 4 | 6 | Vulcan | 219 | 7 | 0 |
| John McCraken | 52 | 8 | 4 | Wallula | 85 | 12 | 6 |
| Jordan | 61 | 6 | 2 | Wenona | 34 | 6 | 2 |
| Joseph Kellogg | 342 | 7 | 2 | Wilavis | 11 | 3 | 9 |
| Josy | ........ | ........ | | W. H. Harrison | 52 | 6 | 8 |
| Kehani | 85 | 6 | 0 | W. S. Mason | ........ | ........ | |
| Katie Weir | 5 | 3 | 5 | Wm. S. Ladd | 700 | 12 | 0 |
| Leona | 133 | 4 | 0 | | | | |

## V V 4.

## IMPROVEMENT OF COLUMBIA RIVER BELOW TONGUE POINT, OREGON.

For details of this work, with status of improvement, see summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

No work was done during the fiscal year 1904 on any portion of this work. The amount expended was on account of care of property and the purchase and fitting up of a new mooring ground on the Willamette River, opposite St. Johns, Oreg., about 6 miles below Portland, Oreg.

It is expected that the balance available for this work will be expended in dredging for deepening the channel below and along the water front of Astoria.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $25,349.41 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 760.66 |
| July 1, 1904, balance unexpended | 24,588.75 |
| July 1, 1904, outstanding liabilities | 71.29 |
| July 1, 1904, balance available | 24,517.46 |

### APPROPRIATIONS.

| | |
|---|---|
| June 3, 1896, from unexpended balance to the credit of improving mouth of Columbia River, Oregon and Washington | $50,000 |
| Act of March 3, 1899 | 71,000 |
| Total | 121,000 |

### COMMERCIAL STATISTICS.

The tonnage over these waters is shown in report for improving Columbia and lower Willamette rivers below Portland, Oreg., but the conditions are different from those reported last year as the commerce over this portion of the stream does not now include the through shipping, which consists principally of wheat and lumber products.

## V V 5.

## IMPROVEMENT OF THE MOUTH OF COLUMBIA RIVER, OREGON AND WASHINGTON.

For extended information and full details, maps and charts of the proposed improvement, with estimate of cost, attention is invited to Annual Report of the Chief of Engineers for 1903, page 2275 et seq.

repairing, fitting out, etc., before she could be at all considered as ready for actual work.

During the months of November, December, and January, when the dredge was in condition to work and could not work on the bar, she worked on a shoal at Smiths Point, inside the harbor, this for the purpose of training her crew, but only 11½ days' work was done on this shoal, as it was found so full of old anchors and chains that the suction pipes were continually being damaged. Whenever possible, however, the dredge was worked on the bar. The boilers gave continual trouble and after attempting to repair them on the ship, it was finally decided that it would be necessary to have the patches thoroughly overhauled. The ship was, therefore, brought to Portland, Oreg., where nine of these patches were taken off and new ones put on, and five other patches repaired. Two stay bolts were renewed and since the completion of this work, on April 18, no trouble has been experienced.

When the dredge reported for duty she was not in trim to dredge on the bar, as her ballast was so disposed as to render her draft too great and somewhat top-heavy, the boat taking a very considerable list with the best management that could be given to the sand in the bins. All the surplus property, materials, and parts not needed during dredging operations were then taken ashore, all of the ballast moved to the lower hold, as much of it forward as practicable, putting the dredge in trim and reducing the light draft to 19 feet forward and 19 feet 8 inches aft. With 300 tons of coal on board, an average load of 900 tons of sand in the bins and the water up to the lower overflow, the usual conditions at the end of one drag across the bar, the draft forward is 21 feet 4 inches and aft 21 feet 9 inches. The load is dumped on completion of drag on account of the shoal bar as compared with the draft of the ship.

The main engines were all overhauled and brasses renewed where required and the engine of the steam launch also put in good condition during the last repairs to the boilers. A small air-compressor plant was installed on the ship, equipped with portable tools, for repairing suction pipes and other parts of the machinery. This plant has proved most valuable. A number of additions and improvements have been made to the dredge since its arrival, the most important being as follows:

A complete set of spare steel suction pipes are provided; cast-steel saddles with tension rods were put on the suction pipes for trussing and stiffening, with the result that the breaking of flange bolts has practically ceased; the after-davits were taken out and remodeled so as to give them a greater overhang as the tendency of the suctions when hoisted was to strike the bottom of the dredge; a small pilot house was built for the protection of the master and wheelman; duplicate parts were obtained of such portions of the pumps as were most liable to wear and breakage.

When no dreding was being done and the dredge was laid up for repairs, the crew was employed in cleaning and general overhauling of the ship.

The coaling of the dredge is done entirely from lighters.

The dredge has shown herself to be very stable and can work in a fairly rough sea, when the depth of water is sufficient, without inconvenience—that is, the draft of the dredge or the limited depth of water on the Columbia River bar prevents dredging more than the roughness of the sea.

For reasons given above, but little work was done by the dredge until the beginning of May, and no satisfactory or continuous records of work performed could be obtained. Up to that time she had dredged 20,580 cubic yards on the Smiths Point shoal, and 94,363 cubic yards on the bar. The dredge having been gotten in fairly good condition, and May and June being exceptionally favorable for work, a fairly accurate statement and estimate of the work that the dredge may be expected to do under existing conditions of channel, is as follows:

*Summary for May–June, by days.*

| | Days. |
|---|---|
| Sundays and holidays | 10 |
| Coaling | 9 |
| Dredging on bar | 40 |
| Rough bar or fog, when dredging could not be done | 2 |
| Repairs | 0 |
| Total | 61 |

*Detailed statement of dredging on the bar, May–June.*

| | |
|---|---|
| Number of days worked | 40 |
| Cubic yards of material dredged and dumped | 141,464 |
| Cubic yards per day, average | 3,535 |
| Time pumping, actual | 131 hrs. 3 min. |
| Time dumping and getting back on range | 78 hrs. 53 min. |
| Time at work, beginning and stopping | 209 hrs. 56 min. |
| Cubic yards per minute, actual pumping average | 18 |
| Length of cut across the bar, average ....feet.. | 8,000 |
| Length of day's work, average | 5 hrs. 15 min. |
| Number of crew employed, average | 76 |

*Cost of dredging on the bar, May–June.*

| | |
|---|---|
| Fuel consumed, 1,433 tons, at $6.10 per ton | $8,741.30 |
| Pay rolls (not including superintendence and office expenses) | 8,160.39 |
| Subsistence | 2,099.04 |
| Deck and engine room supplies consumed, estimated | 1,250.00 |
| Cost of operating, exclusive of superintendence and office expenses, repairs, etc | 20,250.73 |
| Cubic yards material excavated | 141,464 |
| Cost per cubic yard | $0.143 |

Until the channel across the bar is deepened by effect of the jetty, or the work of the dredge, or both, results as favorable as those above given can hardly be expected, but, of course, as the bar channel deepens, the dredge can work to better advantage and thus reduce the cost per yard.

During the ensuing winter the interiors of her boilers will have to be entirely renewed, but it is believed that the shells are still in good condition, and if she is to operate another season there is no question but that she should be changed into an oil burner. The cost of these two items will be approximately $100,000.

A survey of the bar was commenced in June and completed at the close of the fiscal year. This survey shows no radical changes since the examination in January, and the channel depth is at most 1 foot greater or 21 feet at the average of the lower low water. Accompanying this report is a tracing showing the soundings taken during the above-mentioned survey.

The principal and most important changes that have occurred since the survey of June, 1903, are a slight movement seaward of the 24-foot inner and outer curves of the bar, the extension seaward of Peacock Spit on a nearly straight line from Sand Island, and the building up and seaward movement of Clatsop Spit on the north side of the jetty.

The outer 24-foot curve of the bar is in the same position it was last January, when a small survey was made and at which time the distance between the inner and outer 24-foot curves was considerably greater than at either of the June surveys.

Most important developments are taking place in the vicinity of the obstruction buoy, which is in the position of the 31-foot channel of 1895. Here the 24-foot curves are the closer together and in one place give indications of breaking through the crest. The deepest channel across the bar is found here, a movement of about one-half mile northwards since last June.

There has been some scour to the south, on the spit, in elongation of the jetty.

The channel now used by deep-draft vessels is on either side of the obstruction buoy, but until within the last few days has been to the south of this buoy.

The *Chinook* has dredged continuously in the channel used by vessels to the south. It is difficult, owing to the small scale of the map and the necessarily relatively great distance between lines of soundings, to make any deduction as to the effect which the dredge has had, but it is evident from the small changes which have taken place south of this buoy that but little effect has been produced. The main changes in depth have taken place to the north of this buoy where no dredging has been done.

As reported in the last annual report, a conservative estimate of the funds required for remodeling the transport *Grant* into a dredge and operating it was approximately $500,000. The actual expense of remodeling the *Grant* was over $270,000, and the cost of changes, repairs, and purchase of supplies, etc., including operating expenses, to June 30, 1904, was $90,000. The expense of operating the dredge another year will be approximately $120,000, making a total of $460,000 for remodeling the dredge and operating it to June 30, 1905. Repairs to boilers and changing to oil burning will cost, as above indicated, not less than $100,000.

The south jetty is to be completed before any work is commenced on the north side. Its estimated cost is $2,260,000.

The amount previously appropriated is $1,500,000, of which amount, as above shown, approximately $560,000 will have been expended in remodeling and operating the dredge. The total amount to be appropriated for completion of the project for the south jetty is, then, $1,320,000, which sum is accordingly named in the money statement and is to be expended, together with the balance on hand, in dredging and jetty extension. These funds should be appropriated at an early date to insure no further delay to this important work.

This work has been in local charge of Mr. G. B. Hegardt, assistant engineer.

Emergency:[a]
Name of contractor: Geo. W. Sanborn, Astoria, Oreg.
Date of contract: December 4, 1902.
Character of work: Furnishing and delivering coal.
Quantity: Indefinite. (Approximately 2,500 tons.)
Prices, per ton of 2,240 pounds:
$5.50 delivered at Astoria, Oreg.
$5.40 delivered at Kalama, Wash.
$5.40 delivered at Fort Stevens, Oreg.
Approval: Not required.
Date of beginning: January 1, 1903.
Date of expiration: December 31, 1903.

Emergency:
Name of contractor: Oregon Rafting Company, Portland, Oreg.
Date of contract: March 24, 1903.
Character of work: Furnishing and delivering piles.
Quantity: 113,370 linear feet.
Price: 13 cents per linear foot.
Approval: Contract authorized by Secretary of War, January 20, 1903.
Date of beginning: April 15, 1903.
Date of expiration: July 15, 1903. (Extended 15 days.)
Delivery was completed within the extended time.

Emergency:
Name of contractor: Warren & Lester, Warrenton, Oreg.
Date of contract: March 28, 1903.
Character of work: Furnishing and delivering lumber.
Quantity: 759,710 feet, board measure.
Price: 13.40 per 1,000 feet, board measure.
Approval: Contract authorized by Secretary of War, January 20, 1903.
Date of beginning: April 10, 1903.
Date of expiration: July 10, 1903. (Extended 21 days.)
Delivery was completed within the extended time.

Emergency:
Name of contractor: Northwest Construction Company, Astoria, Oreg.
Date of contract: May 27, 1903.
Character of work: Furnishing and delivering stone.
Quantity: 150,000 tons.
Price: 91 cents per ton of 2,000 pounds.
Approved: June 2, 1903.
Date of beginning: Within 12 days from date of contract.
Date of expiration: October 10, 1903. (Extended for reasonable period.)
Contract was terminated in February, 1904.
Total quantity delivered under contract: 124,052 tons.

Formal:
Name of contractor: Northwest Construction Company, Astoria, Oreg.
Date of contract: May 27, 1903.
Character of work: Furnishing and delivering stone.
Quantity: 475,000 tons.
Price: 91 cents per ton of 2,000 pounds.
Approved: July 2, 1903.
Date of beginning: October 10, 1903. (Extended indefinitely.)
Supplement to above contract, dated January 21, 1904, reduces the quantity of stone to be delivered by the contractor from 475,000 tons to 200,000 tons.
Supplemental contract approved February 3, 1904.
Deliveries under supplemental contract began April 21, 1904.
Date of expiration: About December 20, 1904. (In force June 30, 1904.)

Emergency:
Name of contractor: J. R. Bowles, Portland, Oreg.
Date of contract: October 27, 1903.
Character of work: Furnishing and delivering structural steel.

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[a] This contract is also shown in report for "Columbia and Lower Willamette rivers, below Portland, Oreg."

Emergency—Continued.

Quantities and prices: 20 I-beams, 8 inches by 19 feet by 25.5 pounds, all for $242.25; 80 channels, 6 inches by 3 feet 10 inches by 8 pounds, all for $61.33; 80 channels, 6 inches by 4 feet 11 inches by 8 pounds, all for $78.67; 1,000 linear feet angles, ⅜ inch by 3 inches by 3 inches, all for $180; 750 linear feet angles, ⅜ inch by 2½ inches by 2½ inches, all for $110.63; 44 plates, 5/16 inch, cut to drawing, all for $72.30; 44 plates, ¼ inch, cut to drawing, all for $37.30; 44 plates, ½ inch, cut to drawing, all for $78.60; 44 plates, ⅜ inch, cut to drawing, all for $57; 88 plates, 3/16 inch, cut to drawing, all for $30; 44 plates, ¼ inch by 9 inches by 2 feet 6 inches, all for $21.75; 44 plates, ¼ inch by 11 inches by 2 feet 6 inches, all for $26.50; 88 plates, ¼ inch by 6 inches by 11 inches, all for $11.

Approval: Not required.

Date of beginning: } In time to complete delivery within 60 days from date of
Date of expiration: } contract.

Emergency:

Name of contractor: Manning, Maxwell & Moore, New York, N. Y.

Date of contract: December 14, 1903.

Character of work: Furnishing and delivering wheel press and jacks.

Quantities and prices: 1 hydrostatic wheel press for $640; 2 hydraulic jacks, at $130.97 each.

Approval: Not required.

Date of beginning: } Wheel press to be delivered within 56 days and both jacks
Date of expiration: } within 40 days from date of contract.

Emergency:[a]

Name of contractor: George W. Sanborn, Astoria, Oreg.

Date of contract: January 4, 1904.

Character of work: Furnishing and delivering coal.

Amount of work: Indefinite. (Approximately 12,000 tons.)

Prices, per ton of 2,240 pounds: $5.45 for "Roslyn" mine run, delivered at Astoria, Oreg.; $5.45 for "Roslyn" mine run, delivered at Kalama, Wash.; $5.30 for "Roslyn" mine run, delivered at Fort Stevens, Oreg.; $5.65 for "Roslyn" lump, delivered at Astoria, Oreg.; $5.65 for "Roslyn" lump, delivered at Kalama, Wash.; $5.50 for "Roslyn" lump, delivered at Fort Stevens, Oreg.; $5.75 for "Franklin" mine run, delivered at Astoria, Oreg.; $5.75 for "South Prairie" mine run, delivered at Astoria, Oreg.; $5.75 for "South Prairie" mine run, delivered at Kalama, Wash.; $5.75 for "South Prairie" mine run, delivered at Fort Stevens, Oreg.

Approval: Contract authorized by Chief of Engineers, December 18, 1903.

Date of beginning: Whenever required after date of contract.

Date of expiration: December 31, 1904. (In force June 30, 1904.)

Emergency:

Name of contractor: Ellicott Machine Company, Baltimore, Md.

Date of contract: January 18, 1904.

Character of work: Furnishing and delivering pump runners.

Quantity: Two.

Price: $550 each.

Approval: Not required.

Date of beginning: } Both runners to be shipped from Baltimore, Md., within
Date of expiration: } 30 days from date of contract.

Emergency:

Name of contractor: Rand Drill Company, New York, N. Y.

Date of contract: January 21, 1904.

Character of work: Furnishing and delivering air-compressor plant.

Quantities and prices: 1 air compressor, for $967; 1 air receiver, for $71; 1 riveting hammer, No. 60, with 50-foot hose, for $127; 1 calking hammer, No. 2, with 50-foot hose, for $87; 1 calking hammer, No. 3, with 50-foot hose, for $87; 2 calking hammers, No. 1, each with 50-foot hose, for $164; 1 piston air drill, No. 2, with 50-foot hose, for $127; 300 feet extra air hose, for $75.

Approval: Not required.

Date of beginning: } All articles to be shipped from Painted Post, N. Y., within
Date of expiration: } 14 days from date of contract.

---

[a] This contract is also shown in report for "Improving Columbia and Lower Willamette rivers, below Portland, Oreg."

Emergency—Continued.
Date of beginning: } Both locomotives to be shipped from factory within 30 days
Date of expiration: } from date of contract. (Extended for reasonable period.)
Complete shipment was made early in May, 1904.

Emergency:
Name of contractor: The Weir Frog Company, Cincinnati, Ohio.
Date of contract: March 22, 1904.
Character of work: Furnishing and delivering switch stands, etc.
Quantities and prices: 10 switch stands, low, at $10.50 each; 20 switch stands, 7 foot, at $14 each; 2 sets turn-outs, No. 6, at $45.60 per set; 3 sets turn-outs, No. 7, at $46.55 per set; 5 sets cross overs, No. 7, at $93.10 per set; 2 sets turn-outs, made to drawing, at $184.65 per set; 2 sets cross overs, made to drawing, at $277.20 per set; 2 sets cross overs, made to drawing, at $97.05 per set; 750 rail braces, at 11½ cents each.
Approval: Not required.
Date of beginning: } All articles to be shipped from factory within 21 days from
Date of expiration: } date of contract.

Formal:
Name of contractor: Columbia Contract Company, Portland, Oreg.
Date of contract: March 30, 1904.
Character of work: Furnishing and delivering stone.
Quantity: 240,000 tons, more or less.
Price: $1.08 per ton of 2,000 pounds.
Approved: April 14, 1904.
Date of beginning: About April 30, 1904.
Date of expiration: 8 months from date of beginning. (In force June 30, 1904.)

Emergency:
Name of contractor: Pacific Hardware and Steel Company, San Francisco, Cal.
Date of contract: April 1, 1904.
Character of work: Furnishing and delivering structural steel.
Quantities and prices: 23 I beams (total weight, 11,034 pounds), at $2.37 per hundredweight; 184 channels (total weight, 6,471 pounds), at $2.37 per hundredweight; 1,000 feet angles, 3 inches by ⅜ inch (total weight, 7,709 pounds), at $2.37 per hundredweight; 700 feet angles, 2½ inches by ⅜ inch (total weight, 4,562 pounds), at $2.33 per hundredweight; 250 feet angles, 2 inches by ⅜ inch (total weight, 1,209 pounds), at $2.33 per hundredweight; 416 plates, special cut (total weight, 12,040 pounds), at $2.33 per hundredweight.
Approval: Not required.
Date of beginning: } All articles to be delivered within 45 days from date of
Date of expiration: } contract. (Extended for reasonable period.)
Delivery was completed about the 15th of June, 1904.

### COMMERCIAL STATISTICS.

For commercial statistics see report on "Improving Columbia and Lower Willamette rivers, below Portland, Oregon."

## V V 6.

## IMPROVEMENT OF CLATSKANIE RIVER, OREGON.

For details of this work, with status of improvement, see summary of this report.

### OPERATIONS DURING THE FISCAL YEAR 1904.

No work was done during the fiscal year, as the river remained in good condition. The expenditures were on account of purchase of new mooring grounds and in making permanent improvements thereto.

The results in the way of increased depth and width, due to the completion of the project in 1900, were an increase of 2 feet in depth over that portion below the town of Clatskanie where work was done, and shortening the distance to the head of navigation by about 4,500 feet by straightening the channel.

Additional dredging operations will be necessary to maintain the improvement, and $500 is accordingly named in the money statement. This, with the available balance, is to be applied to that purpose.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,656.06 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 463.43 |
| July 1, 1904, balance unexpended | 1,192.63 |
| July 1, 1904, outstanding liabilities | 123.40 |
| July 1, 1904, balance available | 1,069.23 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 500.00 |
| Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | |

#### APPROPRIATION.

| | |
|---|---|
| Act of March 3, 1899 | $13,000 |

#### COMMERCIAL STATISTICS.

The following statement of traffic on the Clatskanie River has been compiled from reports of the various steamers and transportation companies doing business on this river during the year ending December 31, 1903.

| Articles. | Tons. | Articles. | Tons. |
|---|---|---|---|
| Wheat | 54 | Coal | 15 |
| Other cereals | 450 | Cattle and horses (116) | 46 |
| Flour and feed | 139 | Shingles (13,287,000) | 664 |
| Potatoes | 21 | Piles (20,000 linear feet) | 400 |
| Fruit | 3 | Lumber (283,100 feet B. M.) | 368 |
| Hops | 11 | Logs (11,309,000 feet B. M.) | 22,618 |
| Hay | 16 | | |
| General merchandise | 960 | Total | 25,765 |

Passengers carried, 494.

## V V 7.

## IMPROVEMENT OF COWLITZ AND LEWIS RIVERS, WASHINGTON.

### (A) OPERATIONS DURING FISCAL YEAR 1904 FOR COWLITZ RIVER, WASHINGTON.

During the fiscal year dredging and temporary dike construction was carried on.

*Dredging.*—Dipper dredge *No. 1* was towed to the mouth of the river by the tug *Lincoln* on September 14, and commenced widening the channel there. After working there three days she was towed to Huntington bar, below Kelso, by the steamer *Kellogg*, and worked there until the end of October, when she was towed to the Lewis River by the snag boat *Mathloma*. The dredge was accompanied by a house boat and small wood scow.

The following table gives the results and cost of dredging:

| Locality. | Length of cut. | Width. | Depth. | Material removed. | Cost per cubic yard. | Fuel cost. | Labor cost. |
|---|---|---|---|---|---|---|---|
| | *Feet.* | *Feet.* | *Feet.* | *Cu. yds.* | *Cents.* | | |
| Mouth of river | 120 | 50 | 3 to 4 | 700 | 10 | $171.00 | $1,054.69 |
| Huntington bar | 1,550 | 40 | 5 | 11,481 | 10 | | |
| Total | 1,670 | | | 12,181 | | 171.00 | 1,054.69 |

Many snags were encountered and had to be removed by the dredge.

*Dikes and blasting.*—A small party was engaged during part of August and September in building temporary dikes and blowing out snags. The dikes were constructed of rough lumber, weighted down with gravel, and fastened to the ground by bars of iron driven down. These dikes were from 2 to 3 feet high.

The following table shows the dikes constructed at the different localities, also the cost:

| Locality. | Linear feet. | Cost. | | Cost per linear foot. |
|---|---|---|---|---|
| | | Labor. | Material. | |
| Toutle River bar | 500 | $470.58 | $159.75 | $0.74 |
| Toledo bar | 125 | | | |
| Ben Huntington bar | 224 | | | |
| Total | 849 | 470.58 | 159.75 | .74 |

Forty snags were blown out between Kelso and Toledo at a total cost of $68.42.

The results in the way of increased depths since last report have been: By dredging, at the mouth of the river, an increase of from 3 feet to 4 feet for a distance of 120 feet; at Huntington bar, an increase of 5 feet for a distance of 1,550 feet. By dike construction, at Toutle River bar, Ben Huntington bar, and the bar below Toledo an increase of about 6 inches was obtained.

The balance available and the amount required is to be expended in snagging and dredging, etc., in accordance with the approved project.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $3,291.66 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 2,472.53 |
| July 1, 1904, balance unexpended | 819.13 |
| July 1, 1904, outstanding liabilities | 82.20 |
| July 1, 1904, balance available | 736.93 |
| Amount (estimated) required for completion of existing project | Indefinite. |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904 | 7,500.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

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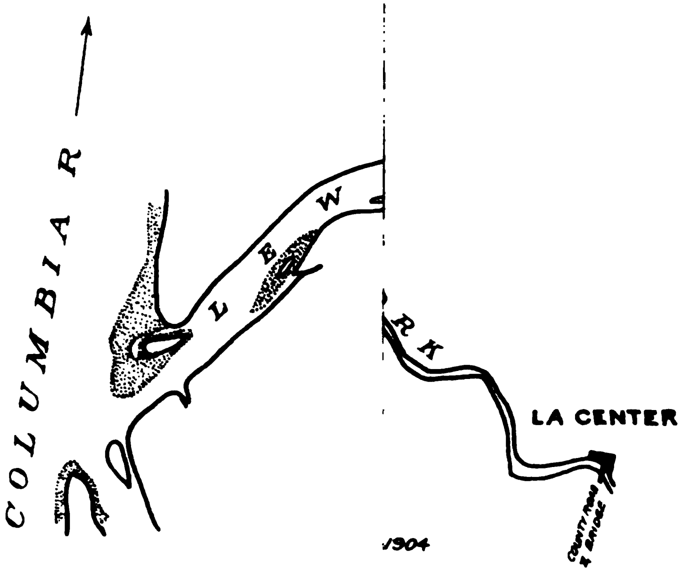

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### APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| June 14, 1880 | $2,000 | June 13, 1892 | $3,000 |
| March 3, 1881 | 1,000 | August 18, 1894 | 3,000 |
| August 2, 1882 | 1,000 | June 3, 1896 | 3,000 |
| July 5, 1884 | 2,000 | March 3, 1899 | 3,000 |
| August 5, 1886 | 2,000 | June 13, 1902 (allotted) | 4,750 |
| August 11, 1888 | 3,000 | | |
| September 19, 1890 | 8,000 | Total | 35,750 |

### COMMERCIAL STATISTICS.

The following statement of traffic on the Cowlitz River has been compiled from reports of the various steamers and transportation companies doing business on this river during the year ending December 31, 1903:

| Articles. | Tons. | Articles. | Tons. |
|---|---|---|---|
| Wheat | 180 | Cattle and horses (206) | 82 |
| Other cereals | 2,401 | Sheep and hogs (4,706) | 853 |
| Flour | 2,107 | Shingles (80,000,000) | 4,000 |
| Potatoes | 3,170 | Piles (534,000 linear feet) | 10,680 |
| Fish | 806 | Lumber (10,266,000 feet B. M.) | 18,835 |
| Hops | 75 | Logs (84,646,000 feet B. M.) | 169,292 |
| Hay | 5,210 | | |
| General merchandise | 7,300 | Total | 221,491 |
| Wood (2,000 cords) | 3,000 | | |

Passengers carried, 8,500.

## (B) OPERATIONS DURING FISCAL YEAR 1904 FOR LEWIS RIVER, WASHINGTON.

The work during the year consisted in dredging a channel 225 feet long, 40 feet wide, with an average depth of 3.8 on the East Fork above the flume near Kinder Rock. This work was commenced on November 3, and was suspended after three days' dredging on account of high water, when the dredge was towed to Portland by the snag boat *Mathloma*.

There is transmitted herewith an index map showing the locality under improvement.

The balance available and the amount required is to be expended in snagging and dredging, etc., in accordance with the approved project.

*Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $2,270.93 |
| June 30, 1904, amount expended during fiscal year, for works of improvement | 856.94 |
| July 1, 1904, balance unexpended | 1,413.89 |
| July 1, 1904, outstanding liabilities | 107.80 |
| July 1, 1904, balance available | 1,306.09 |

| | | |
|---|---|---|
| Amount (estimated) required for completion of existing project | | 5,710.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1904: | | |
| For works of improvement | $5,710.00 | |
| For maintenance of improvement | 1,790.00 | |
| | | 7,500.00 |

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

### APPROPRIATIONS.

| | |
|---|---|
| Act of March 3, 1899 | $10,000 |
| Appropriated by act of Congress approved June 13, 1902, for improving Cowlitz and Lewis rivers, Washington (allotted) | 4,750 |
| Total | 14,750 |

### COMMERCIAL STATISTICS.

The following statement of traffic on the Lewis River has been compiled from reports of the various steamers and transportation companies doing business on this river during the year ending December 31, 1903:

| Articles. | Tons. | Articles. | Tons. |
|---|---|---|---|
| Cereals | 1,587 | Coal | 24 |
| Potatoes | 2,950 | Cattle and horses (1,200) | 480 |
| Fruit | 604 | Sheep and hogs (1,100) | 82 |
| Fish | 145 | Piles (30,000 linear feet) | 600 |
| Hay | 916 | Lumber (40,403,000 feet B. M.) | 52,523 |
| Wool | 30 | Logs (3,125,000 feet B. M) | 6,250 |
| General merchandise | 5,090 | | |
| Wood (6,850 cords) | 10,275 | Total | 81,556 |

Passengers carried, 13,058.

Considerable quantities of timber products are also annually floated out of this stream.

## V V 8.

## GAUGING WATERS OF COLUMBIA RIVER, OREGON AND WASHINGTON.

### OPERATIONS DURING THE FISCAL YEAR 1904.

The self-registering tide gauge at Fort Stevens, Oreg., has been kept in operation during the fiscal year, except for a short period, at which time the gauge was undergoing repairs.

Daily bulletins of the gauge readings were exhibited for information of persons interested in navigation of the Columbia River.

In view of the importance of these gauge readings as a benefit to pilots and others, it is considered a worthy object.

The amount expended during the year was for the hire of gauge keeper and incidental repairs to the gauge.

### *Money statement.*

| | |
|---|---|
| July 1, 1903, balance unexpended | $1,407.79 |
| June 30, 1904, amount expended during fiscal year, for maintenance of improvement | 114.80 |
| July 1, 1904, balance unexpended | 1,292.99 |
| July 1, 1904, outstanding liabilities | 10.00 |
| July 1, 1904, balance available | 1,282.99 |
| Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1904<br>Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. | 1,000.00 |

APPROPRIATIONS.

| Act of— | | Act of— | |
|---|---|---|---|
| August 2, 1882 | $500 | June 3, 1896 | $1,000 |
| July 5, 1884 | 1,000 | March 3, 1899 | 1,000 |
| August 5, 1886 | 1,000 | June 13, 1902 | 1,000 |
| August 11, 1888 | 2,500 | | |
| August 18, 1894 | 1,000 | Total | 9,000 |

## V V 9.

### PRELIMINARY EXAMINATION OF WILLAMETTE RIVER, OREGON, BETWEEN PORTLAND AND OREGON CITY.

[Printed in House Doc. No. 504, Fifty-eighth Congress, second session.]

War Department,
Office of the Chief of Engineers,
*Washington, January 29, 1904.*

Sir: I have the honor to submit herewith report dated August 14, 1902, and report supplemental thereto dated May 1, 1903, by Maj. W. C. Langfitt, Corps of Engineers, on preliminary examination of Willamette River, Oregon, from Portland to Oregon City, made in compliance with a requirement in the river and harbor act of June 13, 1902. He reports the locality to be worthy of improvement by the General Government to a certain extent, and he presents a plan for such improvement, at an estimated cost of $5,100, covering the removal of Copeleys rocks and the deepening of the channel to 4 feet below low water at Jennings, Meldrums, and Magoons bars, and at head of Clackamas Rapids, and this plan is concurred in by the division engineer, Lieut. Col. W. H. Heuer, Corps of Engineers.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, under the provisions of section 3 and 14 of the above-mentioned act, and attention is invited to its report in indorsement of July 11, 1903. The Board is of opinion that it is advisable for the United States to undertake the further improvement of this stretch of the river in accordance with the project and estimate of the district officer.

I concur in the views of the Board.

This stretch of river, and the work proposed for its improvement, are embraced within the limits of an existing project for improving Willamette River from Portland to Eugene, concerning which it has heretofore been stated in Annual Reports of the Chief of Engineers that the physical features of the river are such as to make impracticable the attainment in all sections, at any reasonable cost, of the depths proposed by the project. In view of this, and pursuant to the recommendation of the Board, the district officer has been directed to prepare a revised project, with estimate of cost of improvement, and also to provide therein for certain work opposite Albany.[a]

Very respectfully, your obedient servant,

A. Mackenzie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

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[a] For reports on preliminary examination of the river opposite Albany see House Doc. No. 476, Fifty-eighth Congress, second session.

## REPORT OF CAPT. W. C. LANGFITT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., August 14, 1902.*

GENERAL: I have the honor to submit herewith a report on preliminary examination of the Willamette River, Oregan, between the city of Portland and Oregon City, made in accordance with river and harbor act of June 13, 1902, and letter dated Office Chief of Engineers, July 11, 1902.

The terms of the act relating to the examination are as follows: "Willamette River between the city of Portland and Oregon City."

I have personally examined the Willamette River over the portion named and have corresponded with steamboat companies using it.

There are a number of obstructions and difficulties met with by navigation in the stretch of river referred to, the principal of which are described as follows:

| Locality. | Approximate distance from Portland. | Remarks. |
|---|---|---|
| | *Miles.* | |
| Ross Island Crossing........ | 2½ | Channel is shoal, crooked, and leads toward reef of dangerous bowlders. |
| Reef north of Elk rock...... | 6 | This reef of sharp rocks projects well into the channel and is dangerous in any but clear weather. |
| Reef opposite Oswego furnace. | 7½ | This reef extends too far into the channel and is difficult to avoid in foggy weather or at night. |
| Copeleys rock in Risleys Narrows. | 8¾ | This rock is bare at extreme low water and is in the narrow channel. It is difficult to pass and the banks on both sides are rocky. The current is swift and navigation difficult at all times. |
| Jennings, Meldrums, and Magoons bars. | 10 to 11 | These bars are relatively close together and are troublesome from lack of depth. |
| Clackamas Rapids........... | 11½ | These rapids have always been a source of trouble and are due to the large amount of gravel brought in and deposited by the Clackamas River. |

All the upriver lines of steamers from Portland pass over these waters, and the commerce is therefore large, amounting, for calendar year ending December 31, 1901, to 191,901 tons of freight and 103,971 passengers.

In view of the commerce affected I am of the opinion that improvement of the locality is worthy of consideration by the General Government.

An estimate of cost and plan of improvement can not be made without a more or less detailed survey, and it is recommended that an allotment of $1,200 for this purpose be made.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., August 16, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army, recommending approval of allotment for survey.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*May 15, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

* * * * * * *

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 11, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on the preliminary examination of "Willamette River between the city of Portland and Oregon City," the indorsement of the division engineer thereon, the accompanying report of the survey of the locality, the report of the division engineer thereon, and other data available.

The Board is of opinion that in view of the present and immediately prospective commerce it is advisable for the United States to undertake the further improvement of this stretch of river, in accordance with the project and estimate of the district officer.

In the Report of the Chief of Engineers for 1901, a statement is made to the effect that the physical features of the Willamette River are such as to make impracticable the attainment in all sections, at any reasonable cost, of the depths proposed by the project. This opinion is repeated in the Report of the Chief of Engineers for 1902.

In view of these statements the Board is of opinion that this project should be revised, and recommends that the district officer be directed to prepare such a revised project, with estimate of cost.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

## SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., May 1, 1903.*

GENERAL: I have the honor to submit herewith report on survey of the Willamette River, Oregon, between Portland and Oregon City, made in compliance with the river and harbor act of June 13, 1902, and letter from Office of Chief of Engineers, dated September 29, 1902. Preliminary examination was made and report submitted under date of August 14, 1902, as required by letter from Office Chief of Engineers, dated July 11, 1902.

The terms of the act relating to this locality are as follows: "Willamette River between city of Portland and Oregon City."

The survey was made by Mr. David B. Ogden, assistant engineer, assisted by Mr. H. L. Gilbert, junior engineer, and the following extract is made from Mr. Ogden's report:

> The distance between Portland and Oregon City is 12½ miles, and the survey was confined to points along this stretch where shoals or obstructions of any nature were known to exist.
>
> The present project for the improvement of the Willamette River calls for a depth of 12 feet at low water to Oswego, 8 miles above Portland, and a minimum depth of 3½ feet above that point.
>
> Proceeding upstream the first obstruction is found opposite Ross Island, 2 miles above Portland (Madison Street Bridge), at which point the deep water divides into two channels, and a gravel bar is formed 1,000 feet in length on which there is but 7 feet depth at low water.
>
> The results of the survey of this section of river are shown on the map herewith (sheet 1).
>
> The second obstruction is found opposite Sellwood, 3½ miles above Portland, at which point there is a short shoal carrying about 8 feet at low water. The results of the survey of this section are shown on the map herewith (sheet 2).
>
> Reefs at Elk rock, Oswego, and Copeleys rock, 5½, 7¾, and 9 miles above Portland, respectively, have been surveyed and are also shown on sheet 2.
>
> Three gravel shoals carrying less than 4 feet at low water are found on the 10 to 11 mile stretch above Portland. These are named Jennings, Meldrums, and Magoons bars, respectively, and the results of the survey of this section of the river, together with that of Clackamas Rapids, 11¼ miles above Portland, are shown on the map herewith (sheet 3).
>
> Above Clackamas Rapids there are no obstructions to Oregon City.

At Oswego, 8 miles above Portland, is located the Oregon Iron and Steel Company's plant, operated at present only to a limited extent for the manufacture of gas and water pipe. This company is at present the only one which has any occasion to use the river above Ross Island for boats of greater depth than that required for ordinary river steamers. The company, in response to inquiry, states that it has in contemplation the transportation of ore to their works direct from Mexico in steam schooners of a draft of about 17 feet, but that this plan has not been definitely decided upon. The company at present receives by river 6,000 to 8,000 tons of pig iron and coke annually, delivered by barges of light draft. The present project of 12 feet, if carried out, would probably serve for some time to come any development of deep-draft commerce that may arise over this portion of the river, for the reason that for about eight months in the year the river is usually not less than from 4 to 6 feet above low water.

To secure 12-foot depth to Oswego, as required by present project, would require the removal of 48,000 cubic yards of gravel and sand at Ross Island shoal, and 8,000 cubic yards of similar material at Sellwood shoal, a total of 56,000 cubic yards, to give a channel 150 feet in width at each place. More or less annual dredging would probably be necessary for maintenance. The estimated cost of this dredging is as follows:

| | |
|---|---|
| 56,000 cubic yards excavation, at 25 cents per cubic yard | $14,000 |
| Annual maintenance, say | 2,500 |

The plan of constructing a deflecting dam, as indicated by broken lines on sheet 1, across the high-water channel at head of Ross Island as a means of maintaining the dredged channel has been considered. The expense, however, would be quite considerable, not less than $30,000, for a dam carried to 8 feet above low water, and therefore it is not recommended at present.

Complaint has been made that Elk rock and Oswego reefs are somewhat of a menace in foggy weather. This is no doubt true, but many other points present the same danger. It is believed that there is ample width of channel at each of these points for navigation in general, and that buoys placed as indicated on sheet 2 will be all the work that is necessary or advisable at present.

Copeleys rock, sheet 2, is more or less dangerous to navigation by reason of its location almost in mid-channel just below a deflecting rock ledge on the left bank, with a rocky island below. The current is swift and boats have difficulty in keeping clear of the rock. This rock should be removed, and the estimated cost of the work is as follows:

| | |
|---|---|
| 600 cubic yards rock excavation, at $6 per cubic yard | $3,600 |

Jennings, Meldrums, and Magoons bars, and the bar at head of Clackamas Rapids, sheet 3, carry a depth of 3 feet or more at low water. These should be dredged to carry not less than 4 feet depth for a width of 150 feet, and a buoy should be placed on the bowlder point at the head of the rapids as an aid to navigation at high water. The estimated cost of all this work is as follows:

| | |
|---|---|
| 6,000 cubic yards excavation, at 25 cents per cubic yard | $1,500 |

All the work outlined in this report is really a part of that called for by the present project for the improvement of the river. However, as at present there is but little if any necessity for the 12-foot channel to Oswego, the dredging to obtain it should be deferred. All the other work, however, should be done as soon as funds are available, and to this extent the locality is worthy of improvement by the General Government at the present time. This work can be done for $5,100.

The following are the commercial statistics for the calendar year 1901, pertaining to the upper Willamette River, of which the portion of the Willamette River here considered forms a part:

| | |
|---|---|
| Freight .....tons.. | 191,901 |
| Number of passengers | 103,971 |

Very respectfully, your obedient servant,

W. C. Langfitt,
*Major, Corps of Engineers.*

Brig. Gen. G. L. Gillespie,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., May 8, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army. I agree with Major Langfitt that Copeleys rock should be removed and the channel deepened to 4 feet below low-water level at Jennings, Meldrums, and Magoons bars; also at head of Clackamas rapids, at a total estimated cost of $5,100.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

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## V V 10.

## PRELIMINARY EXAMINATION OF WILLAMETTE RIVER, OREGON, OPPOSITE ALBANY.

[Printed in House Doc. No. 476, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, January 26, 1904.*

SIR: I have the honor to submit herewith a report, dated July 23, 1902, and supplemental report dated April 13, 1903, by Capt. W. C. Langfitt, Corps of Engineers, on preliminary examination of Willamette River opposite Albany, Oreg., with a view to ascertaining whether a diversion of said stream at that point would result in injury to navigation, ordered by the river and harbor act of June 13, 1902. In the opinion of Captain Langfitt the improvement is worthy of consideration by the General Government, and he presents a project for the protection of the bank, at an estimated cost of $27,000, which is forwarded by the division engineer, Lieut. Col. W. H. Heuer, Corps of Engineers, with favorable recommendation.

These reports have been reviewed by the Board of Engineers for Rivers and Harbors, in accordance with the provisions of sections 3 and 14 of the above-mentioned act, and attention is invited to its report of July 17, 1903. The Board concurs in the opinion of the district officer and the division engineer that the formation of a cut-off across the peninsula opposite Albany would probably result in injury to navigation and to the commerce of that city, and that it is desirable for the United States to undertake the work needed to prevent a diversion of the stream at that point.

The act of June 13, 1902, provides also for a preliminary examination of Willamette River between the city of Portland and Oregon City, and after consideration of reports thereon the Board of Engineers for Rivers and Harbors has recommended, in a separate report,[a] that the project for the improvement of Willamette River above Portland be revised. In the opinion of the Board the work opposite Albany should form a part of this revised project and should be carried out with due regard to the relative importance and urgency of the various parts of the general project.

The views of the Board are concurred in by me.

The district officer has been directed to prepare the revised project recommended by the Board.

The reports of the district officer and the Board of Engineers for Rivers and Harbors on the stretch of river from Portland to Oregon City will be submitted to the Secretary of War with a separate letter.[a]

Very respectfully, your obedient servant,

A. Mackenzie,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. Elihu Root,
*Secretary of War.*

## REPORTS OF CAPT. W. C. LANGFITT, CORPS OF ENGINEERS.

United States Engineer Office,
*Portland, Oreg., July 23, 1902.*

General: I have the honor to submit herewith a report on preliminary examination of the Willamette River, Oregon, immediately opposite the town of Albany, made in accordance with river and harbor act of June 13, 1902, and letter dated Chief of Engineers' Office, July 11, 1902.

The terms of the act relating to the examination are as follows:

> Willamette River, opposite Albany, with a view to ascertaining whether a diversion of said stream at that point would result in injury to navigation.

The town of Albany is situated on the right bank of the Willamette River, 106 miles above Portland, and is one of the principal shipping points on the upper river.

Opposite Albany the river flows practically east and west, while about 1¼ miles below it makes a radical change of course almost in a northwesterly direction, thus forming a peninsula of the comparatively low land opposite the town.

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[a] Printed in House Doc. No. 504, Fifty-eighth Congress, second session.

As this land is frequently overflowed during the high-water period and the set of the current is diagonally across the peninsula, it has been apprehended by the residents of the community that the river may ultimately make for itself a new channel that will leave the town on a slough and away from the main river, and also destroy the northerly approach to a steel county bridge which spans the river at this point.

By reference to early surveys, it would seem that the fears of the community are more or less well founded as a change in the left bank above the bridge is very apparent, the high-water current having scoured away the bank for 1,000 feet or more. There are also indications that this high-water current has begun the formation of a new channel across the peninsula.

As has been said, Albany is one of the principal shipping points for grain, hops, and produce on the upper Willamette, and it is believed that a diversion of the river at this point would be an injury to navigation and to the commerce of this section.

It is estimated that a survey for the purpose of preparing a plan and estimate for improvement at this point will cost $350.

For the reasons above stated, it is believed that this improvement is worthy of consideration by the General Government and it therefore is recommended that the survey be made.

Very respectfully, your obedient servant,

W. C. LANGFITT,  
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,  
*Chief of Engineers, U. S. A.*  
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,  
*San Francisco, Cal., July 25, 1902.*

Respectfully forwarded to the Chief of Engineers, United States Army, recommending that a survey be authorized.

W. H. HEUER,  
*Lieut. Col., Corps of Engineers,*  
*Division Engineer.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,  
*September 2, 1902.*

Respectfully returned to Captain Langfitt.

It would appear that the proposed work covered by the examination called for properly forms a part of the present project for work on Willamette River, and that such survey as may be necessary to secure the information called for could legitimately be made in connection with work under existing project, which would permit an estimate to be made of the approximate cost of necessary work and a comparison of such cost with the commerce interested, with a view of so extending the preliminary report as to give all the facts. Under the conditions named, a survey in connection with work of improvement is authorized, and on its completion a further preliminary report based on the additional information obtained will be submitted.

To be returned.

A. MACKENZIE,  
*Acting Chief of Engineers.*

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 24, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors, constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Seventh indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., July 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on the preliminary examination of "Willamette River, opposite Albany, with a view to ascertaining whether a diversion of said stream at that point would result in injury to navigation," the indorsement of the division engineer thereon, the accompanying report of the district officer on the survey of the locality, the indorsement of the division engineer thereon, and other data available.

The Board concurs in the opinion of these officers that the formation of a cut-off across the peninsula opposite Albany would probably result in injury to navigation and to the commerce of that city, and that it is advisable for the United States to undertake the work needed to prevent a diversion of the stream at that point.

In its report on the "Willamette River between the city of Portland and Oregon City," the Board recommended that the project for the improvement of the Willamette River be revised. This recommendation is here repeated.

The Board further recommends that the work opposite Albany should form a part of this revised project and should be carried out with due regard to the relative importance and urgency of the various parts of the general project.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

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## SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., April 13, 1903.*

GENERAL: I have the honor to submit the following report on survey of the Willamette River, Oregon, opposite Albany, made in accordance with the river and harbor act of June 13, 1902.

The terms of the act are as follows:

> Willamette River, opposite Albany, with a view to ascertaining whether a diversion of said stream at that point would result in injury to navigation.

Report on preliminary examination was submitted under date of July 23, 1902, recommending that a survey be made and submitting an estimate of its cost. This survey was authorized by the Chief of Engineers September 2, 1902, and has now been completed, map[a] of which is herewith.

The town of Albany is situated on the right bank of the Willamette River, 100 miles above Portland, and is one of the principal shipping points for grain, hops, and general produce on this section of the river.

The river for a mile above and opposite the town flows practically east, while about 1½ miles below the town it makes a change of direction, northerly, and again almost northwesterly, thus forming a peninsula of a comparatively low section of land opposite and below the town. The land forming the peninsula is frequently overflowed, and the set of the current is diagonally across it, following a natural depression, as indicated by the dotted line shown on the locality map.

As of recent years there has been more or less scour along the north bank opposite Albany near the head of this depression, there has been considerable apprehension by the residents of the community that the river may ultimately cut for itself a new channel across the peninsula, leaving Albany inland and also destroying the northerly approach to a county steel bridge which spans the river at this point. The condition of the bank and the ground adjacent thereto at the head of this high-water channel is shown in detail on the map.

In December, 1902, and January, 1903, the river was twice out of its banks in freshet, the last time registering 31 feet above low water. During these times of freshet it is reported that the current flows more strongly across the peninsula than in the main river. During the January freshet several bents of the trestle approach at the north end of the county bridge were undermined and washed out.

From the indications of scour along the north bank above the bridge and by channels here and there across the adjacent land it would seem that the fears of the community are more or less well founded. In the interests of navigation, also, further encroachment along this bank should be, if possible, forestalled by the construction of a line of revetment following approximately the 22-foot contour from the upstream high land to some point about 1,000 feet below the bridge, as indicated on the map herewith.

To accomplish this as cheaply as consistent with permanency, the following plan is recommended: The abrupt earth bank generally above the 15-foot contour should be given a 1 on 1½ slope down to the gravel bar, which shows no tendency to wash. This slope is then to be covered with riprap stone paving, and the small channels in the adjacent land to be closed at their heads by brush and stone cross dikes carried to the general level of about 20 feet above low water. It will also be advisable to fill with earth and protect with brush and stone the small depressions indicated by cross lining.

An estimate of the cost of this work is as follows:

| | |
|---|---|
| 8,000 cubic yards earthwork, at 35 cents | $2,800 |
| 5,000 cubic yards riprap stone paving, at $4 | 20,000 |
| 300 cords willow brush, at $3 | 900 |
| 300 cubic yards rock, at $2.50 | 750 |
| Engineering, contingencies, etc, 10 per cent | 2,550 |
| Total | 27,000 |

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[a] Not printed.

The danger of the river leaving Albany is not immediate, and all the work outlined should really form part of the regular improvement of the stream, but in view of the limited funds usually provided for this river it will be impossible to provide for it out of the regular appropriations. From this point of view, the work is worthy to be undertaken by the General Government when funds are available therefor.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Captain, Corps of Engineers.*

Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., April 16, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army

The rock revetment proposed will probably be effective in holding the river in place at this locality, unless the river leaves its bed at some point above the western end of the revetment, of which no mention is made in the report. Assuming that this point has been considered and no danger exists, the project is recommended for approval.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

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## V V 11.

## PRELIMINARY EXAMINATION OF YAMHILL RIVER, OREGON.

[Printed in House Doc. No. 78, Fifty-eighth Congress, second session.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: The river and harbor act approved June 13, 1902, makes provision for a preliminary examination of Yamhill River, Oregon, with a view to prolonging the period of navigation, and I have the honor to submit herewith, for transmission to Congress, reports on the subject, dated March 17 and September 18, 1903, by the local officer, Maj. W. C. Langfitt, Corps of Engineers, together with indorsements thereon by the division engineer and the Board of Engineers for Rivers and Harbors provided for by section 3 of said act.

The Yamhill enters the Willamette River 40 miles above Portland, Oreg. A lock and dam constructed by the United States upon the

Yamhill 7 miles above its mouth provides a waterway navigable at low stages to the vicinity of McMinnville, an important shipping point 17 miles above the Willamette. This waterway is available at stages of less than 5 feet and more than 12 feet, measured above the lock. At intermediate stages the lock is submerged, while an impassible fall exists at the dam. During the past three years the lock has been closed to traffic, due to high water, for a total of two hundred and thirty-one days.

The district officer is of the opinion that continuous navigation can be provided for if the dam be modified by the substitution of a movable dam for the upper 6 feet of the present structure. The cost of the work already done has been about $100,000. The full benefit of this expenditure can not be attained without some modification of the existing structure. In his report of September 18, 1903, Major Langfitt submits an estimate of $28,560 as the cost of the necessary modification of the existing structures.

The subject-matter has received careful consideration at the hands of the Board of Engineers for Rivers and Harbors, and the conclusions of the Board are expressed in its indorsement of October 29, 1903, as follows:

> In view of the advantages to commerce that would follow the execution of the proposed work, as fully set forth in third indorsement hereon, the Board believes that the expenditure involved is reasonable, and that it is desirable that the United States should undertake the improvement.

I am not convinced that adequate commercial advantages would follow the further expenditure proposed, and therefore do not feel justified in recommending it at the present time.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

HON. ELIHU ROOT,
*Secretary of War.*

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## REPORTS OF CAPT. W. C. LANGFITT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., March 17, 1903.*

GENERAL: I have the honor to submit the following report relative to preliminary examination and estimate of cost of project with a view to prolonging the period of navigation on the Yamhill River, Oregon, in pursuance to instructions contained in letter from Office Chief of Engineers, dated June 23, 1902, and river and harbor act approved June 13, 1902.

In its present condition the Yamhill lock can only be operated for navigation until a 5-foot stage is reached in the upper river, at which time the upper gates are submerged and the lock consequently closed. During the three years since the completion of the lock it has been closed to traffic on this account for a total of two hundred and thirty-one days.

The original plan and estimate for the lock, as published in the Annual Report of the Chief of Engineers for 1895, page 3604, contemplated the possibility of boats passing over the dam at such times as the lock walls should be submerged, but experience has shown this to be impracticable, owing to the heavy fall on the crest of the dam, the difference in level between the upper and lower pools not being fully equalized until the river reaches a stage of about 12 feet above the walls.

The plan of raising the lock walls to 5 feet or more above their present height has been considered as one means of prolonging continuous traffic, except during times of extreme freshet; but this does not recommend itself, for the reason that the lock walls and wing wall occupy approximately two-fifths of the high-water section of the river, and any additional construction in height of wall would gorge the water above the lock and occasion a greater rise than under the present condition when the water flows over the top of the walls.

From the present gauge records of this office it is estimated that an increase of 5 feet in height of wall would provide for 3 feet more rise of river than under the existing conditions. From the gauge records of the lock since the time of its opening, September, 1900, to March 1, 1903, it is estimated that, had the walls originally been carried 5 feet above their present height, the lock, notwithstanding, would have been closed during these three high-water seasons for an average of twenty-nine days each year, instead of seventy-seven days, as the record now shows. Hence, it will be seen that, while raising the walls 5 feet would prolong the period of navigation to a considerable extent, it would not afford the means of continuous traffic during high-water periods.

Another objectionable feature in the plan of raising the walls is that the increased height would no doubt so change the current conditions at high water as to present new difficulties in preserving the banks adjacent to the lock and dam, as severe experience has shown since their construction that it is impossible to anticipate the effect of any change on banks of such unstable nature.

The following is an approximate estimate of the cost of raising the lock walls throughout 5 feet, including the necessary increased protection to the adjacent banks:

| | |
|---|---|
| 1,100 cubic yards concrete, placed with lock in operation, including forms, platforms, storehouses, etc., at $15 | $16,500 |
| 2 sets new gates, with anchorages, maneuvering gear, etc | 6,000 |
| 500 cubic yards additional riprap under wing and land walls, at $3 | 1,500 |
| 600 cubic yards additional slope paving, at $4 | 2,400 |
| 100 cubic yards extra heavy riprap below dam, at $4 | 400 |
| Remodeling operating machinery, bridge trestles, etc., removing and replacing | 1,000 |
| | 27,800 |
| Superintendence, contingencies, etc., 20 per cent | 5,560 |
| Total estimated cost | 33,360 |

In view of the cost and limited benefits to be obtained through raising the lock walls, as well as of the probable complication arising in the protection of adjacent banks, this plan is not recommended.

As an alternative it is suggested that the high-water interruptions can be more effectually prevented by such alterations to the dam as will permit the lowering of the crest in times of freshets. This, instead of increasing the freshet head and the consequent danger of injury to the adjacent banks, will allow the pool levels to be soon equalized and the pressure and scouring action will be greatly decreased. It is

Yamhill 7 miles above its mouth provides a waterway navigable at low stages to the vicinity of McMinnville, an important shipping point 17 miles above the Willamette. This waterway is available at stages of less than 5 feet and more than 12 feet, measured above the lock. At intermediate stages the lock is submerged while an impassible fall exists at the dam. During the past three years the lock has been closed to traffic, due to high water, for a total of two hundred and thirty-one days.

The district officer is of the opinion that continuous navigation can be provided for if the dam be modified by the substitution of a movable dam for the upper 6 feet of the present structure, and submits an approximate estimate of cost. The cost of the work already done has been about $100,000. The full benefit of this expenditure can not be attained without some modification of the existing structure to effect the purpose proposed by the district officer.

Should continuous navigation be made possible, it appears probable that a line of steamers will be operated between Portland and McMinnville. Such a line may be reasonably expected to have an effect upon freight rates, both directly and indirectly, sufficient to warrant the expenditure involved in the proposed modification, provided that this does not greatly exceed the approximate estimate already made.

For the reasons above given the Board recommends that the district officer be directed to prepare final detailed estimates of cost of the proposed modification, and is of the opinion that the improvement of the "Yamhill River, with a view to prolonging the period of navigation," is advisable, if the work above mentioned can be done at reasonable cost.

For the Board:

H. F. Hodges,
*Major, Corps of Engineers,*
*Senior Member Present.*

[Fourth indorsement.]

Office Chief of Engineers,
U. S. Army,
*June 12, 1903.*

Respectfully returned to Major Langfitt.

The views of the Board of Engineers for Rivers and Harbors are concurred in, and Major Langfitt is requested to prepare and submit the estimates desired by the Board.

When the necessary record has been made these papers will be returned to this office.

By command of Brigadier-General Gillespie:

A. Mackenzie,
*Colonel, Corps of Engineers.*

[Eighth indorsement.]

War Department,
Office of the Chief of Engineers,
*Washington, October 1, 1903.*

Respectfully returned to the Board of Engineers for Rivers and Harbors with report containing estimates as requested.

By command of Brigadier-General Gillespie:

H. F. Hodges,
*Major, Corps of Engineers.*

[Ninth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., October 29, 1903.*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the accompanying report and estimate of cost of the district officer, dated September 18, 1903, for the modification of the dam at Yamhill lock, Yamhill River, Oregon, and the indorsement of the division engineer thereon.

The district officer estimates the cost of the proposed improvement at $28,560. The division engineer concurs.

In view of the advantages to commerce that would follow the execution of the proposed work, as fully set forth in third indorsement hereon, the Board believes that the expenditure involved is reasonable, and that it is desirable that the United States should undertake the improvement.

For the Board:

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,*
*Senior Member of the Board.*

### PLAN AND ESTIMATE OF COST OF MODIFICATION OF DAM IN YAMHILL RIVER, OREGON.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., September 18, 1903.*

GENERAL: In compliance with instructions contained in fourth indorsement, dated Office Chief of Engineers, June 12, 1903, I have the honor to submit herewith detailed plan and estimate of cost of the proposed modification of the dam at Yamhill lock, Yamhill River, Oregon.

Further consideration of the conditions at Yamhill lock shows the advisability of dividing the crest of the dam into sections for the reason that a single crest 100 feet long of any of the bear-trap types would be subjected to considerable distortion in the operation of raising and lowering.

The idea of using the "Parker" type of bear-trap dam has therefore been abandoned, for the reason that the necessary diaphragms or abutments between the sections would occupy too much of the available section of the river. In lieu of this type there has been substituted a dam invented by Maj. W. L. Marshall, Corps of Engineers, which allows of the necessary division into sections, the diaphragms of which will form no obstruction and which possesses all of the necessary requirements. As in the case of the former plan and estimate the lower portion of the existing dam is to form a foundation and base for the new "Marshall" dam. The general plan of the dam is shown upon the four tracings[a] submitted herewith, numbered 1, 2, 3, and 4.

The "Marshall" dam will have a total length of 100 feet, consisting of four divisions of 25 feet each, and for each of these divisions there will be a gate. The gates will each have two leaves rigidly built together in the form of an inverted L, and to the under leg of the L there will be attached a loose lower leaf swinging freely on a hinge from its bottom edge. This arrangement is shown on sheet No. 2. The gates are to be separated from each other as to their lower legs and leaves by diaphragms securely built into the fixed dam. These diaphragms are to make of the combined lower leg and leaf of each division, in effect, a piston that may be operated upon by water entering through a conduit from the upper pool or released through a like conduit to the lower pool. The upper leg of each leaf when in an upright position will form a continuous crest along a line 5 feet below the top of the lock wall.

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[a] Not printed.

The operation of the "Marshall" dam will be controlled by conduits leading from a point upstream from the dam to the pool below, and also across stream in a direction lengthwise of the dam, as shown by sheet No. 1. In these conduits will be controlling valves which will be operated from the top of the lock wall. The three sections of the dam toward the land end will be operated as a unit and will have controlling valves and conduits in common. The section nearest the lock will be operated independently of the other three sections by means of a small separate conduit and controlling valves. This arrangement for the independent operation of this section is to provide for the release of any accumulation of drift above the dam. The small branch conduit at the land end is for the purpose of flushing the large conduit.

A summary of the drawings submitted is as follows:

Sheet No. 1 shows the general outline of the arrangement of the dam.

Sheet No. 2 shows in transverse section the upper and lower legs of the gate and swinging leaf, the position of the main conduit, and the arrangement of fastening bolts, etc. It also shows in dash-and-dot lines the position of the gate when raised.

Sheet No. 3 shows the front elevation of one division of the dam, the conduit and position of openings from it into the chamber behind the gate, the bracing of the gate, the location of I-beams, the position of diaphrams, etc.

Sheet No. 4 shows in plan the location of the hinge casting, the bolt fastenings, the top bracing of diaphrams, the bracing of gates, etc.

An estimate of the cost of the dam, complete, at the present market price for labor and material, is as follows:

| | |
|---|---:|
| Removing old work, including cofferdams, etc. | $6,000 |
| 800 cubic yards concrete, at $10 | 8,000 |
| 50,000 feet B. M. lumber, in place, at $50 | 2,500 |
| 6,200 pounds bolts, washers, etc., at 10 cents | 620 |
| 2,400 pounds roller castings and hinge shafts, at 15 cents | 360 |
| 28,000 pounds angle irons, I-beams, turnbuckles, etc., at 15 cents | 4,200 |
| 5,600 pounds steel castings, at 20 cents | 1,120 |
| 5,000 pounds valves, connections, and maneuvering gear, at 20 cents | 1,000 |
| Total | 23,800 |
| Engineering, superintendence, and contingencies, 20 per cent | 4,760 |
| Total estimated cost | 28,560 |

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE, NORTHERN PACIFIC DIVISION,
*San Francisco, Cal., September 22, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army.

This is a very ingenious type of dam, and so far as known has not yet been tried on any public work. It appears to be practicable, the details have been carefully considered, and its estimated cost is only about $4,000 in excess of the bear-trap dam originally contemplated for this locality.

A trial of this type of dam is recommended.

W. H. HEUER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

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## V V 12.

## MODIFICATION OF HARBOR LINES IN COLUMBIA RIVER AT ASTORIA, OREGON.

ASTORIA CHAMBER OF COMMERCE,
*Astoria, Oreg., July 28, 1903.*

SIR: At the last regular meeting of the Astoria Chamber of Commerce, the following resolution was adopted:

> Whereas the pierhead line in the Columbia River along Astoria east of the Astoria and Columbia River Railroad depot does not furnish a sufficient depth to accommodate the deeper draft sea vessels; and
>
> Whereas the manufacturing interests now established there, and others contemplated, desire and need a channel depth at their wharf front sufficient to accommodate the largest commercial ships; therefore
>
> *Be it resolved,* That the Secretary of War be requested to direct proper persons to examine the same and recommend such changes in the pierhead line and other improvement to the harbor line and channel as they shall deem necessary and conducive to the interests of the harbor and city.

Your early attention to this matter will be greatly appreciated by the chamber of commerce.

Respectfully,

JAS. W. WELCH, *President.*

Attest:

C. R. HIGGINS, *Secretary.*

HON. SECRETARY OF WAR,
*Washington, D. C.*

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*August 6, 1903.*

Respectfully referred to Maj. W. C. Langfitt, Corps of Engineers, for report.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

[Fifth indorsement.]

U. S. ENGINEER OFFICE,
*Portland, Oreg., November 17, 1903.*

Respectfully returned to the Chief of Engineers, United States Army, attention being invited to report herewith. * * *

W. C. LANGFITT,
*Major, Corps of Engineers.*

[Sixth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 2, 1903.*

Respectfully returned to the Secretary of War.

The Chamber of Commerce of Astoria, Oreg., submits copy of resolution requesting a modification of the existing harbor lines along a portion of the water front of that city on the Columbia River. Copies of this petition[a] are herewith, having been presented by every member of the Oregon delegation in Congress with request for favorable consideration.

The matter was referred to the local engineer officer, Major Langfitt, and attention is respectfully invited to his reports[a] thereon of September 3 and November 17, 1903, herewith, from which it appears that there is no serious objection to a modification of the lines as requested. The proposed change will permit the outer end of wharves to be carried to deeper water, and thus enable larger vessels to be brought to the docks with little or no dredging.

As a result of his investigation, which included a public hearing, Major Langfitt submits the accompanying tracing[a] on which are delineated and described the bulkhead and pierhead lines which in his opinion will best subserve the various interests involved.

Concurring in the views of the local officer, I recommend that the modified lines selected be approved and that the Secretary place his approval upon the tracing herewith, which has been prepared for his signature.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

NOTE.—The lines referred to above and shown on the map mentioned were approved by the Acting Secretary of War December 4, 1903, the approval being noted on the map.

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## REPORT OF MAJ. W. C. LANGFITT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
*Portland, Oreg., November 17, 1903.*

GENERAL: Complying with fourth indorsement,[a] dated Office Chief of Engineers, September 11, 1903, on letter of Astoria Chamber of Commerce dated July 28, 1903, requesting a change in harbor lines of

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[a] Not printed.

Astoria east of the Astoria and Columbia River Railroad dock, I have the honor to submit the following report:

Public meeting, duly advertised, was held in the rooms of the Astoria Chamber of Commerce on November 4, 1903. Stenographic report[a] of the proceedings is herewith. Two communications[a] received since date of the meeting are also inclosed, as well as the communication[a] submitted by the Oregon Railroad and Navigation Company at the public meeting.

For the purpose of discussion, at the public meeting a map was exhibited on which was shown a modification, substantially as on the map,[a] sheet B, with my previous report[a] dated September 3, 1903. This map had also been on exhibition at the chamber of commerce rooms, Astoria, and duplicate in this office, statement to that effect being incorporated in the notices in the newspapers and otherwise distributed.

This line seemed to meet the views of the interested parties except as to its eastern part, where more depth was desired (see statement[a] of Mr. Hume and letter[a] from Columbia Land and Investment Company), and as to the line in front of the Oregon Railroad and Navigation Company's wharf, where a change not shown was asked for in their communication.

The following views expressed in the previous report, referred to above, are here repeated:

> The condition of the channel in 1894 and in 1900, and the harbor lines are shown on blueprints A and B herewith. Shoaling of the channel between the years mentioned is shown by comparison of these maps, and also that practically from the Oregon Railroad and Navigation Company's wharf to near the United States buoy depot, much less water is found at the pierhead line at the latter date than formerly.
>
> At present I see no objection to a modification of the harbor lines throughout this whole distance which would enable the outer ends of wharves to be carried to the deeper water.
>
> There is available for dredging in this channel approximately $24,000 belonging to the appropriation for improving mouth or Columbia River, Oregon and Washington, below Tongue Point, but if the harbor line remains in its present location this sum would give but very limited relief. With change here suggested, and indicated approximately on sheet B, fairly good depths would be found at the harbor line, and the sum above mentioned would be available for keeping the channel open and the dredging required be much reduced in amount.

After due consideration of the whole subject, the conclusion was reached that certain changes in harbor lines of upper Astoria could be adopted with but slight, if any, probability that a recession will ever become advisable or desirable. A new harbor line is therefore shown on tracing[a] herewith for the portion of the harbor under consideration. These new lines have been advanced throughout as far as is considered safe and proper at the present time. With the assistance of dredging it is expected that sufficient depths to meet all reasonable demands can readily be obtained and maintained along the proposed harbor line in future, except in that portion along which Sylvia de Grasse reef projects. To comply with the request of Mr. Hume and others for a greater moving out of the harbor line in the eastern part than recommended would narrow the channel too much and not be well suited, and probably injurious to its maintenance below. The new harbor line in front of Mr. Hume's mill gives 18 to 20 feet in depth, whereas the present one only gives 14 feet, an increase of 4 to 6 feet. A small amount of dredging will easily give Mr. Hume the depth he desires, even if the construction of wharves does not cause a deepening in front.

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[a] Not printed.

The change asked for by the Oregon Railroad and Navigation Company seems unobjectionable, and is incorporated on the tracing with a very slight change.

Inclosed is a description of the harbor lines as recommended, commencing at the easterly limit of the present harbor lines and extending westerly to the west end of the Oregon Railroad and Navigation Company's dock. This description is also on the tracing. A blueprint[a] is also herewith showing the new and old harbor lines for comparison.

The bulkhead line has been moved out parallel to the new line, and, as before, is placed 300 feet from it.

Very respectfully, your obedient servant,

W. C. LANGFITT,
*Major, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*

### DESCRIPTION OF PIERHEAD LINE.

Beginning at a point on the prolongation westerly of the south boundary of the tract of land known as the United States buoy depot, said point being 1,240 feet from a stone monument on said south boundary, on the beach between high and low water lines.

Thence southwesterly to a point in the prolongation northerly of the center line of Fifty-first (Fifth) street, Alderbrook, said point being 2,100 feet from the intersection of the center lines of Fifty-first street (Fifth) and Birch street, Alderbrook.

Thence southwesterly to a point in the prolongation northerly of the center line of Forty-seventh (First) street, Alderbrook, said point being 1,280 feet from the intersection of the center lines of Forty-seventh (First) street and Birch street, Alderbrook.

Thence westerly to a point in the prolongation northerly of the center line of Thirty-ninth (Gaines avenue) street, Adairs Astoria, said point being 1,220 feet from the intersection of the center lines of Thirty-ninth (Gaines avenue) street and Bond (Second) street, Adairs Astoria.

Thence southwesterly to a point in a prolongation northerly of the center line of Twenty-second (West First) street, Shiveley's Astoria, said point being 800 feet from the intersection of the center lines of Twenty-second (West First) street and Commercial (Water) street, Shiveley's Astoria.

Thence southwesterly to a point in the prolongation northerly of the center line of Nineteenth (West Fourth) street, Shiveley's Astoria, said point being 470 feet from the intersection of the center lines of Nineteenth (West Fourth) street and Commercial (Water) street, Shiveley's Astoria.

Thence westerly to a point in the prolongation northerly of the center line of Fifteenth (West Eighth) street, Shiveley's Astoria, said point being 450 feet from the intersection of the center lines of Fifteenth (West Eighth) street and Commercial (Water) street, Shiveley's Astoria.

The last-mentioned point is the same point as shown on map of Astoria Harbor line, approved April 22, 1891, by the honorable Secretary of War.

The bulkhead line to run parallel with and 300 feet southerly from the pierhead line.

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[a] Not printed.

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Yaquina River, Oreg., examination from mouth to Elk City ................ [illegible]

Yazoo River, Miss.:
  Improvement above mouth ..............................
  Improvement of mouth, including Vicksburg Harbor ..............
Yellow Mill Pond, Bridgeport, Conn. (*see* Bridgeport) ..................
Yellowstone National Park, improvement of ...................
Yonkers, N. Y., harbor lines in Hudson River ......................
York Harbor and River, Me.:
  Bridge (Sewell's) obstructing navigation ...................
  Examination and survey ............................
York River, Va., improvement of ............................
Yuba River, Cal. (*see* Sacramento River *and* California Débris Commission) .................................... 1, 645, 70
Yukon River, Alaska, trail to Coldfoot ..........................

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